WIRE
& WIRE PRODUCTS

In This Issue:

The Future of the Wire Industry
By L. D. Granger

The Profits of High Overhead
By L. S. Horner

German Annealing Practice
By Dr. H. Altpeter

Review of Recent Patents

News

August 1926

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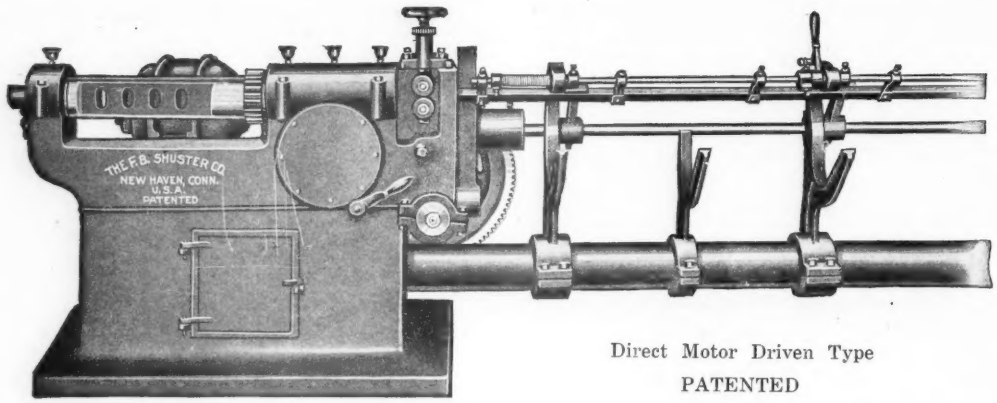

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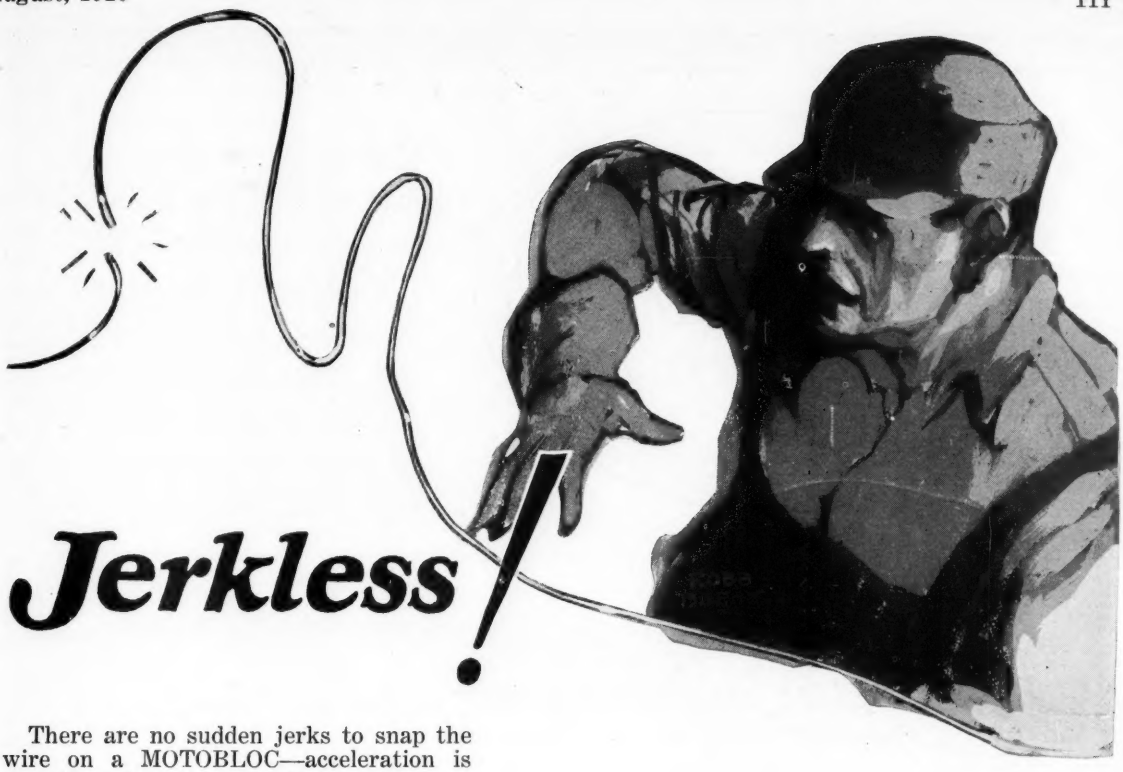

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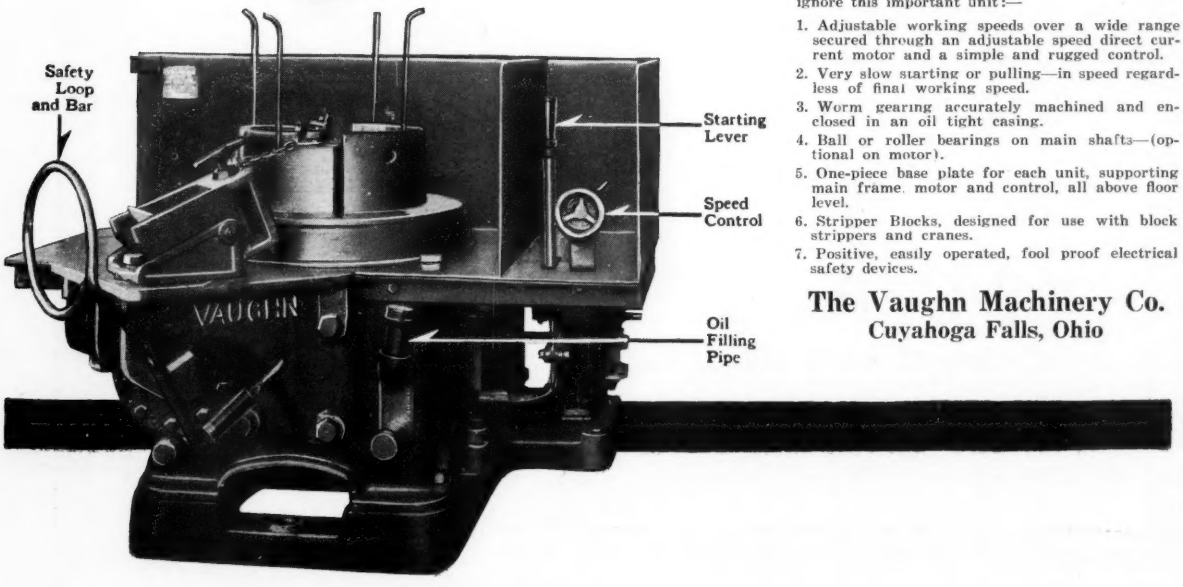

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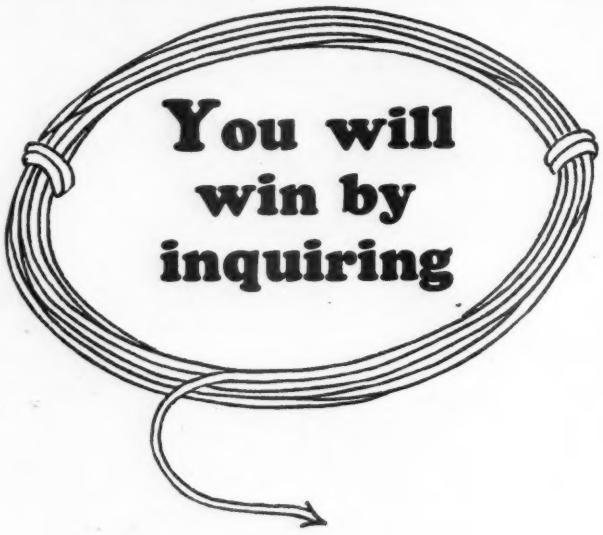

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SINCE early youth, one of our pet hobbies has been the opening of letters. We look at them all, from the solicitation of funds for marble palaces for editors to earnest requests for positions from captains of industry.

From time to time this column has reproduced letters of commendation, and we are thankful to say they still come in to gladden our hearts. But the other letters have their little thrill, too.

One particular type of matter that pleases us is the demand for information. This type of letter has come in from every grade and kind of manufacturer, from foremen, superintendents, and every day workmen.

A trade journal such as **Wire & Wire Products** must not only seek the highways and byways for new and interesting ideas, but to be of greatest service to its readers, it should act as a clearing house for those seeking information.

Wire & Wire Products will not only do this always but, whenever possible, will publish under a Question and Answer Department the diverse and helpful problems that our editorial advisors have tried to solve.

If you have a production problem, a knotty technical detail; if you wish the name of a company making some necessary items, this publication will place its full resources at your command to get the correct answers.

While **Wire & Wire Products** places itself at the disposal of the industry, you, Kind Reader, can do an incalculable good by furnishing for publication any problems you yourself have worked out that you think will be of benefit to the industry as a whole. No matter what it may be, the unsolicited contributions to these columns will have our most earnest consideration and heartfelt thanks.

The Publisher.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 1 **August, 1926** **No. 4**

Contents

The Past, Present and Future of the Wire Industry By L. D. Granger - - - 115

Continuous Wire Drawing, By Kenneth B. Lewis - - 116
A discussion of controlled loop, and modified slip machines.

The Manufacture of Steel and Iron Wire in Germany
A study of German annealing Practice.
By Dr. H. Altpeter - - - 118

Gas Furnaces in Wire Mills, By J. B. Nealey - - - 120
Annealing, baking and tempering in gas furnaces. Some prominent installations.

The Profits of High Overhead, By L. S. Horner - - 122

My Thirty-five Years of Wire, By Geo. A. Paff - - 124

Editorials - - - - - - - - - - - 128

Wire in the News - - - - - - - - - 129

Lubrication in Wet Wire Drawing, By C. P. Gulick - 130

News of the Industry - - - - - - - - 132

Digest of Literature - - - - - - - - 134

Review of Recent Patents - - - - - - 135

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WIRE
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Vol. I AUGUST, 1926 No. 4

The Past, Present and Future of the Wire Industry

By L. D. Granger
Wickwire Spencer Steel Company

THE origin of our great modern wire drawing industry is shrouded in almost pre-historic mystery. There seems to be no doubt that from Biblical days to a few hundred years before 1000 A. D. the softer and probably the precious metals were hammered into sheets, the sheets cut into narrow strips and the strips hammered or filed into a rough approximation of wire. From this time on, a few curious old documents and books refer to wire, much by inference, but with some direct detailed instructions.

Among the earliest of these scientific treatises was one written by a monk, Theophilus by name. In those days the clergy had a monopoly not only on religion but also on learning, so it is not strange that he was moved to record the "Schedule of the Various Arts" of his day. As his connection with these arts was largely along the lines of church decoration, he naturally records the beauties of the incense burners, candelabra and such similar articles. In his book is the first known description of a wire drawing die, and a literal translation might be used for the description of some of the dies used today.

Further along in historical record—indicating also that trade unionism is not of modern origin—is a record, in the archives of the City of Paris, laying down rules and regulations for master wire drawers and apprentices.

Mr. L. D. Granger is chief metallurgist of the Wickwire Spencer Steel Co., and Associate Editor of Wire and Wire Products.

This brings us up to about the year 1300 A. D. For another space of a century or so nothing definite has been found. The first picture of a wire drawing die is found in a work published in 1418 which depicts a workman seated in a swinging chair, a "shank plate," exactly like our modern type, held vertically, the shank driven in a block of wood, and the man oscillating back and forth, pulling out a length of wire by means of tongs with every swing. The revolving block was known previous to this time but did not come into general use until later.

From these rude beginnings the advances were evidently to speed up production. In all probability our predecessors were troubled with competition, and each strove to out-do his neighbor to produce ten pounds of wire a day instead of five. A water wheel with a crank supplanted the foot-pushed swing, and a windlass, operated by man power, supplanted the water wheel; but it was not until about the end of the seventeenth or the beginning of the eighteenth century that the "modern" frame with several blocks driven by bevel gears from a shaft, evolved.

The length of wire in one piece increased from a few feet to several pounds, and the necessity for a method of winding up and storing the drawn wire made the utilization of the revolving block necessary.

In this country, finishing mills were in operation certainly during the last quarter of the eighteenth century and possibly earlier. From that time to the fairly recent past, little real progress was made in wire drawing.

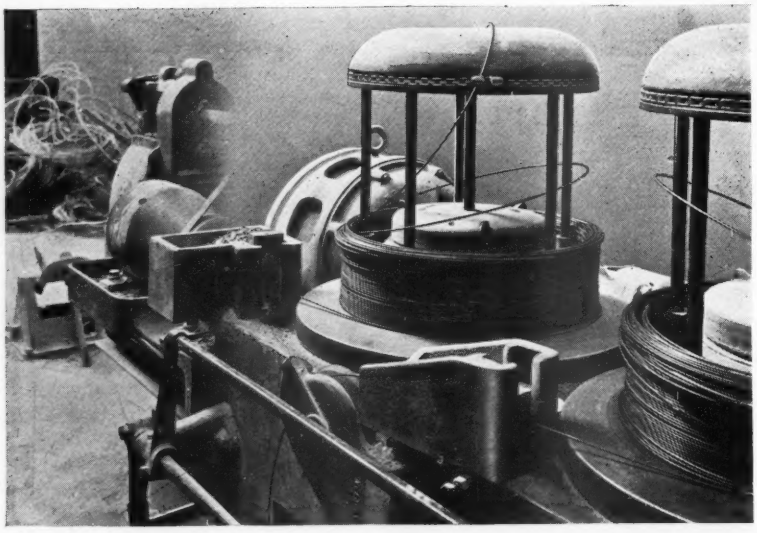
(*Continued on page 138*)

Continuous Wire Drawing

PART II.

An authoritative discussion of controlled loop and modified slip machines

By Kenneth B. Lewis
Morgan Construction Co.



By courtesy of the Morgan Construction Co.

A type of patenting gas furnace. The illustration shows the outlet on to the next block with a free axial feed.

Modified Slip

FROM the basic idea of the slip machine there developed two main schools of thought in continuous wire drawing. Both recognized that machines must draw dry wire or be satisfied with a small and uninteresting field. Both realized that the circumferential slip of dry coated wire on the intermediate blocks was the point of attack. One stuck to purely continuous drawing, (that is, drawing in such a way that the same number of pounds per minute is passing every point on the machine at a given time) and tried to prevent the slip from doing damage. The other faction modified the continuity of the process by allowing controlled loops to form between drafts.

We shall deal first with those who kept the slip. The first move was a search for material too hard to be cut by the slipping wire, and yet not harsh enough to cut the wire or strip off its coating. This search was only moderately successful. The ideal material was never found. Next came efforts to transfer the slip to some other place.

Slip Transferred as Friction

An interesting and measurably successful method was that which made the drawing surface a split ring movable in a circumferential groove in the block, like a piston ring. When the wraps of wire were tight the ring sprung in and was driven by the block. When a disturbance of speed relations caused a little slack the ring lost its traction. It must be kept in mind that divergence from synchronism in speeds and reductions in wire drawing must be in one direction only, and in such direction that wear in the dies causes an approach to synchronism. If synchronism is reached, the next step is wire breakage. Slip machines are therefore slipping all the time and at every point. The split ring was fairly effective, but a good deal of heat developed which had to be taken care of by water cooling—a mean problem on a rotating part. Machines of this general type designed by James Horton were the basis of a heralded "revolution" in the early 1900's, featuring the Iroquois Machine Company as builder, the Shenandoah Wire Company as operator, and the referee in bankruptcy as undertaker. Horton machines are still in use in France, where the writer has found them well regarded in certain quarters.

Differentials

Other sub-classes of the slip-transfer group contain those schemes in which die wear is reflected in varying strain on the wire between blocks, which in turn, operating through differential gearing, expanding pulleys, or the like, effects speed changes which bring the system back into balance. Generally speaking there is a certain normal strain between each die and its block, departure from which causes speed changes which bring the strain back to normal. Carter and Hodgson patented a differential gear machine in England in 1905. Barron and Crowther have numerous patents on the same general scheme, but with the blocks superimposed on one center so as to resemble a single block with 3 or 4 flanges. Oslund and Johnson build similar machines in America, and the patents granted and experiments conducted are too numerous to list.

Sleeper and Hartley have experimented with a machine in which changes in die pull

change effective diameters of driving pulleys. It is an ingenious and workable device as are in fact all the differential machines that have survived childhood.

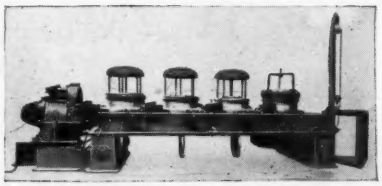
A proposal (patented, we believe) to drive each block with its own motor which shall be directly and delicately responsive in speed to the strain on the associated wire has not been worked out but a much similar scheme will be described in a later section.

Differential gear machines are used quite extensively in England, where labor conditions practically force the wire manufacturer into continuous drawing, but in America they do not find favor. Their faults are of two kinds. Structurally speaking, they are expensive when carefully designed and built, and hopeless when not. As operating units they have this weakness, that in roughing down low carbon stock the drafts must be lightened, since the pull required to actuate the differential mechanism must be subtracted from the safe die pull. This weakness has no effect in the case of high carbon steel, for the maximum die pull imposed by consideration of quality is far below the breaking strain of the wire, while in soft wire the two are as close together as they can possibly be pushed. In all differential machines there is an unnaturally rapid rate of wear on the blocks, showing that the differential mechanism is only partially responsive to the demands on it, and that much direct slip persists.

Controlled Loops

Experiments with controlled loops probably date back to within 24 hours of the birth of continuous drawing. The "potential" overfeed at each block, which normally is converted into slip, becomes an actual overfeed as soon as the operator hooks a stick around it and backs away. If he could keep on backing away there would be no slip. Many schemes to hold this loop under control are in actual operation. Machines of this class, rather crudely designed and built modifications of the "full-slip" machines, generally built in the wire mill repair shop, are commonly found at work on wire annealed at 12½ to 15 gauge and going 4 or 5 drafts to about No. 20. Many have been fathered by some foreman who has carried the infection from a previous connection. J. P. Dooley has been tireless in spreading the gospel of controlled loops.

In the typical controlled loop machine the wire between one block and the next die is carried out, or up, around a sheave which is moved outward by springs or counterweights as fast as the growth of the loop will permit. The travel is of course limited, but before the sheave reaches the end of its slide the operator can re-set it by throwing another wrap around the previous block, using for this purpose some of the slack in the loop. If by reason of die wear the sheave begins to pull in dangerously near its inner limit of travel a new loop can be made up for it by stealing a wrap or two from the preceeding block. Slip is held down to fairly low proportions in these machines, but still the best of them requires much redressing of drawing surfaces. They take a good deal of attention, and the number of machines operable per man is disappointingly low, but they are holding their own. Under the best of management and conditions they nearly double the output of a wire drawer. While more flexible than the straight slip machines still they are very dependent on close control of raw material, expert operators, excellent and unvarying practice in the annealing and cleaning house, and long straight runs of work.



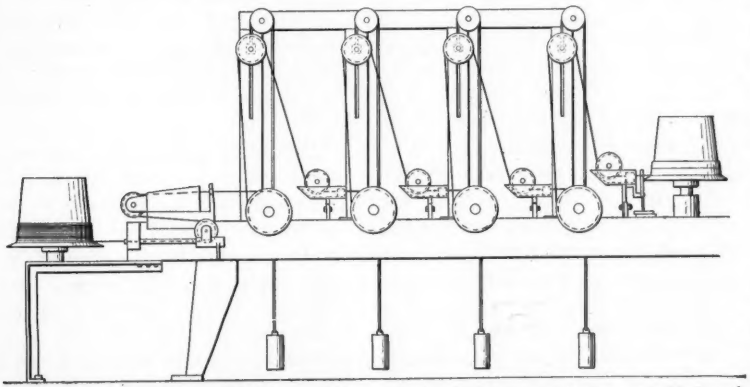
By courtesy of the Morgan Construction Co.
A full view of the axial feed, continuous wire drawing machine shown in detail on the preceding page.

Under the heading of controlled loop machines mention must be made of two variants. One, probably never seriously tried, uses the movement of the sheave (or die box, or whatever member is made responsive to changes in die pull) to actuate speed changing mechanism at each block. The other, patented by Walter Clarke and, it is said, about to receive an extended trial by a large corporation, causes the movement of the sheave to operate a rheostat, or otherwise affect directly the speed of a motor, one of which drives each block of the series.

Morgan-Connor Machines

There has been left for the last a machine that is somewhat akin to the "controlled loop' class, but which might perhaps be subheaded as "self-controlled loop." On its blocks, which are

Continued on page 140)



A schematic view of the controlled loop machine. In this type, the wire between one block and the next passes around a movable guide pulley supported by counter-weights. The slip is thus taken up by the movement of the guide.

The Manufacture of Steel and Iron Wire in Germany

By Dr. Ing. H. Altpeter of Mannheim

Translated from Stahl & Eisen, 1925
By Carl Marx

This installment of Dr. Altpeter's articles discusses German annealing practice

AS already mentioned, the purpose of the annealing of the wire after it has been drawn down through a number of drafts, is to restore its initia- ducility. The annealing will remove the internal stresses which have been set up as the result of the mechanical work done on the wire in the drawing operations, and will decrease the hardness and breaking-strength, while at the same time it will increase its pliability, malleability and elongation.

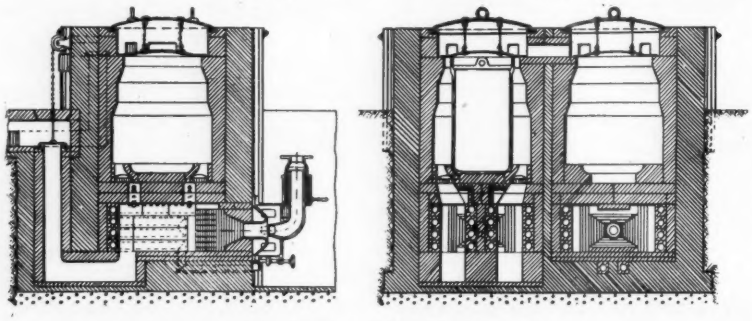


Fig. 1. Pot annealing furnace.

The time required to effect a thorough annealing of any given type of wire depends upon a number of circumstances. Various investigators have experimented with the process, but do not agree as to what is the best time and temperature. Heyn (Zeitschrift des Vereins deutscher Ingenieure, 1900, 44, 433-441) suggests annealing iron wire at 900°C for from ½ to 1½ hours, but Goerens recommends a much lower temperature for an equal length of time. All agree however that too long annealing is to be avoided, as it will cause a crystalline structure in the wire which will render it unusually brittle.

Two general types of annealing systems are employed. The first uses the so-called annealing pot furnace, and the other a muffle-furnace. (See Fig. 1.) In the first type, the wire which is to be annealed is placed into wrought-iron or steel annealing pots, covered with an iron cover made airtight by luting with clay. These pots are then placed into a furnace and kept at a temperature of from 700 to 900°C for several hours. The wrought iron pots, as furnished in Germany by the firm of Th. Lammine of Muhlheim-on-the-Rhine, have recently been extolled for their superiority over steel pots; the advantages claimed being more rapid and uniform heating due to the thinner walls, and also because of their comparatively lighter weight.

The corrosion of such wrought iron pots is no greater than with steel pots, and they will last as long as steel, which is in general about 300 annealing operations per pot. Formerly individual pot-furnaces were used for heating, but more modern practice is to heat a number of pots in one furnace, the heating being done either with water-gas or with regular producer-gas. The economies thus effected are considerable, as it formerly required from 15 to 20%, of the weight of the material annealed, of coal, while with multiple furnaces this is only from about 6 to 10%, according to the relative space occupied by the wire.

The actual length of time required for the annealing operation varies according to the quality of the wire and the chemical analysis of the material of which it is made, but is generally between 4 and 5 hours, which includes heating up, annealing, and cooling down. On removing the annealing-pots from the furnace, they are allowed to cool slowly in a pit, which is generally located near the furnace. Figure 1. illustrates the type of apparatus just described, being especially adapted for steel wire.

Iron or steel wire annealed in pots varies in color from blue to black, due to the formation of magnetic iron oxide as the result of the oxidation brought about by the air. Unless the wire is to be sold with this color, or if it is to be further drawn down, this coating of magnetic iron oxide must be removed by pickling, as has already been described.

Bright or metal-colored wire is also made. This is produced by carefully excluding the air from the annealing-pots so as to prevent the oxidation of the wire. This can be accomplished either by using smaller pots carefully sealed, or by packing the wire in cast-iron borings. Considerable experience is necessary to produce properly annealed bright wire. The firm all ready mentioned furnishes a bright-annealing pot, which is provided with a cover having a pipe through which it is possible to pass ordinary illuminating gas while the annealing is going on, so as to prevent the oxidation of the wire.

Another, very advantageous, method for bright-annealing steel wire is that introduced by Vitry, and known by his name. In this process, the annealing pots containing the wire, while still hot directly after removal from the furnace, are placed in a closed cooling-chamber, into which illuminating gas is passed. This penerates the pots and

prevents all oxidation of the wire. After cooling in the gas for from four to five hours, the wire will be perfectly bright in appearance and exceptionally soft.

A special advantage of the Vitry method (which was covered by German Patent No. 35713) is the longer life of the annealpots, as they will not scale nearly as much due to oxidation. Another favorable point is that when wire is bright-annealed it will require no pickling before resuming the drawing operations. If ready for use, and if drawn wet, it will be brighter than if annealed by other methods. The cost, when the price of acid used for pickling, and the loss in weight due to removal of the oxide is considered, is actually lower than when regular annealing is practiced.

Other operations requiring heat are usually conducted in conjunction with the annealing operations. The waste heat escaping from larger muffle-type of annealing-furnaces, is usually great enough to effectively operate smaller annealing-ovens for treating steel wire-drawing dies, and for heating drying chambers for pickled and limed wire.

The larger annealing installations, such as the muffle type of furnaces, have the great advantage that they allow continuous operation. The wire can either be passed through the furnace as a single strand or the coils can mechanically be placed within the furnace, gradually pushed along and eventually discharged when cool, all by means of suitable mechanical devices. To prevent undue oxidation of the wire, it is the usual prac-

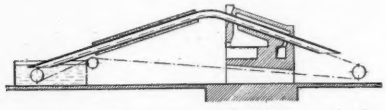


Fig. 2. Muffle-furnace.

tice to pass inert gases through the furnace, gases lighter than air, such as nitrogen or illuminating gas, being preferable. When properly operating, these continuous annealing-furnaces will yield wire sufficiently bright to allow further drawing without pickling, and which will be almost as fine in appearance as pot-annealed bright-wire.

The muffle furnaces are usually heated by means of water-gas or producer-gas, and considerable economies in heating have been realized.

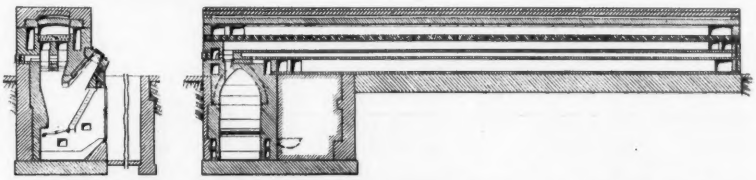


Fig. 3. In this type of annealing furnace the wire passes through the heating zone and is reeled up at the far end.

Annealing furnaces of this type have been described in Stahl und Eisen, 1915, p. 287, being those of the Walther System. Figure 2 is a diagramatic view of this furnace.

Annealing furnaces in which the wire passes through the heating zone and is reeled up at the far end, usually do not have a steel retort, but are provided with specially formed hollow refractory chamotte bricks, which have a number of cylindrical passages through which the wire is pulled. The entrance and exit of these openings is closed by means of a dam of charcoal powder, so as to prevent undue loss of heat and too great oxidation of the wire. The constructional details of this type of furnace are given in Figure 3.

The temperature in the annealing furnaces is measured with either electrical or optical pyrometers. The actual temerature attained by the wire being annealed can be accurately determined by means of Seger cones. These are ceramic-ware cones of definite softening-point.

The changes taking place in wire during drawing has been the subject of a large number of investigations. The mechanical effects of drawing upon wire can be accurately described. Stribeck, Goerens, Heyn and others have done some remarkably fine work in this field and have adequately discussed the complicated phenomena which occur.

Ingot iron, either after rolling or when annealed, consists of ferrite crystals mixed with pearlite and with occluded slag particles. The drawing operation causes a decided stretching of the crystals, which becomes greater the more often the wire is passed through the die. There is, however, no fixed relationship between the amount of stretch and the number of drawing operations on the wire, as the ferrite grains will become more or less oriented after a while, this depending somewhat upon the quality of the metal. The degree of stretching is, moreover, greater than 1; that is to say it is possible to differentiate between annealed and undrawn wire immediately, as the latter exhibits, on microscopical examination, grains of ferrite which are elongated to such an extent that their length in the direction of the wire is greater than their width. Besides this, the ferrite crystals at the center of the wire are more elongated than those nearer the surface. Heyn has explained this as being due to the fact that the interior of the wire is subjected to greater strain than the outer portions, the latter being subjected rather to pressure than to elongation.

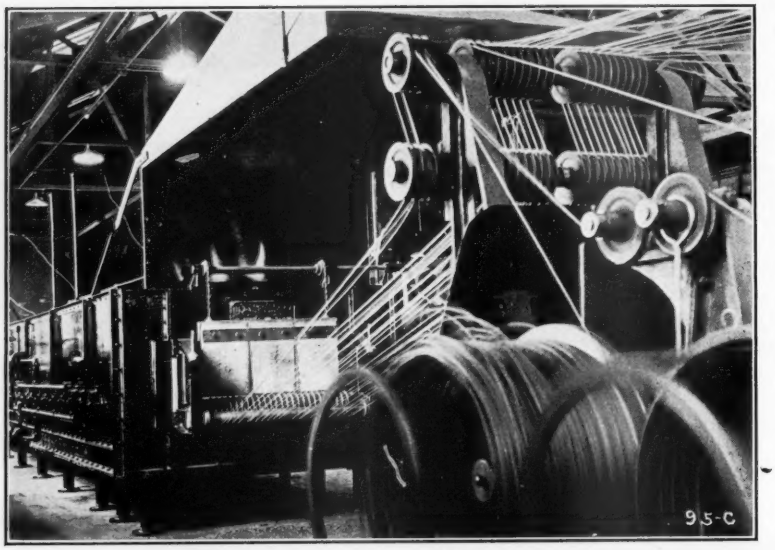
In any case, however, drawn wire is not free from internal stresses, the individual particles being under considerable strain. This is made evident by a lowering of the specific gravity of the metal as the result of drawing, and a more ready solubility in acids, Furthermore, the drawing exerts a marked influence upon the hardness, tensile strength, stretch, and resistance to bending and torsional strains. All these are properties of vital interest to the consumer of the product. It would lead too far afield to indulge in a lengthy discussion of these features at this

(*Continued on page 136*)

Gas Furnaces in Wire Mills

Annealing, baking and tempering in gas furnaces---Some prominent installations

By J. B. Nealey
Surface Combustion Co.



A type of patenting gas furnaces. The illustration shows the outlet end. These furnaces utilize city gas.

MODERN civilization has come into being through mass production, fast transportation and quick communication. The part that wire has played is a major one as witness the absolute dependence of the telephone and telegraph on this product. In fact the entire electrical industry is dependent on wire, and so on through a myriad of uses.

The manufacture of steel wire has progressed greatly in recent years through the development of the science of heat treating. The gradual transition of heat treating from an art to a science together with the exact duplication of laboratory conditions on a commercial scale has made possible wire of very exacting specifications including greater strength, ductility and durability for a wide variety of uses.

Working hand in hand with the metallurgist to achieve this end has been the manufacturer of furnaces and combustion apparatus for the correct application of heat to the many processes involved.

In the manufacture of wire at the Stewart Hartshorn Company, Newark, N. J., coke, producer gas and electricity were successively used as a fuel in the open annealing, pot annealing, baking, patenting and tempering furnaces, only to be discarded in the long run for city gas.

The output yielded by the old type producer gas patenting furnace was doubled in this new furnace fired by city gas. A tempering unit formerly heated electrically, and which was changed over to city gas, now yields the same output at practically half the fuel cost while the new gas fired bake oven will produce about twice the output obtained previously.

Double lead pans or pots were installed at a big steel plant which makes wire. These pans which were used for patenting wire contained melted lead and were fired with gas. Some twelve to fifteen strands of wire are drawn through the first pan for heating to a temperature of 1600°F. At the outlet end of this pan the wires pass through a pile of coal or coke to prevent cooling. The wires are then drawn through the second pan or lead bath, at a temperature of 900°F., in which quenching occurs. After leaving the second pan the wire is cooled in the air and wound up on spools. These pans or furnaces are 7′ long x 21″ wide x 6″ deep. A test covering 80 hours showed an output for that time of 104,755 pounds for two units, or approximately 665 pounds per hour per unit; a unit consisting of one high temperature and one low temperature pan. The average gas consumption per hour was 725 cu. ft. for each unit. A 48 hour competition test was made against two oil fired units with the comparison of 1450 cu. ft. of gas at about 80 cents per M. against 12½ gallons of oil per hour at a cost of 10 cents per gallon at the burner. The uniform temperature distribution, lower fire risks and storage and handling elimination, together with the clean atmosphere all favor gas. Furthermore, firing by gas prevents over-heating of the pots in spots and through this the life of the pots is more than doubled.

Gas fired wire enamel furnaces are coming into wider and wider use every day as their simplicity of design, economy of operation and absolute control are increasingly recognized.

A dozen or more gas fired wire enameling furnaces are installed at one of the plants of the largest manufacturing companies in the country. These were

designed and installed by the Surface Combustion Company of New York. These furnaces are vertical, being some 30 or 40 feet in height, 10 feet wide and approximately 25 feet deep. The wire is unwound from reels, close to the bottom or charging end, dips into a bath of enamel and is slowly pulled through the furnace by means of winding reels located over the top or discharge end of the furnace. The enamel is baked on the wire during its travel through the furnace which is fired by velocity burners with the gas at high pressure. A very large number of strands are treated at the same time.

Wire enameling furnaces are also installed at one of the biggest wire mills in the country. These ovens are 12 feet long, 3 feet wide and about 1½ feet high, internal dimensions. This furnace is horizontal, the wire being suspended on reels located at both ends. The wire dips into a bath of enamel and travels through the furnaces where the enamel is baked on in a temperature range of from 800 to 850 degrees F. These furnaces are also fired by gas.

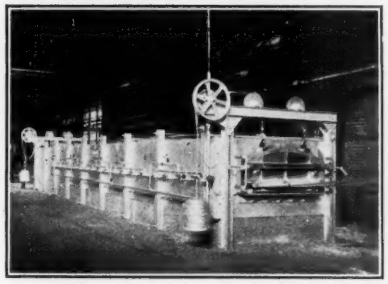
The Surface Combustion Co. furnaces utilize city gas. This system is peculiar to itself. Combustion is maintained in a back pressure atmosphere so as to exclude all secondary air, and the flames are directed through a refractory lined, bell mouthed burner so as to develop the maximum possible amount of radiant heat. The flues are restricted and arranged so as to distribute the hot gas uniformly and to release them at the lowest possible temperature. The prevention of cold air leakage into the combustion chamber is a desirable feature because it prevents oxidizing effects; also by its cooling action the cold air would lower the furnace efficiency.

Baking furnace installed in the plants of Stewart-Hartshorn Co.

The installations are so designed that the furnace atmosphere can be varied at will, by either simply changing the gas orifice sizes in the inspirators in the high pressure gas system, or by changing the insert in the inspirators in the low pressure air-gas system. This is an advantage because in certain classes of manufacture, such as vitreous enamel baking, an oxidizing atmosphere must be maintained in the furnace to insure against the reduction of the metallic oxide bases in the enamel. In certain other industries, such as metal treating, an oxidizing atmosphere would be injurious to the metal, causing it to oxidize with the formation of scale. To minimize this production of oxide or scale, a reducing furnace-atmosphere is maintained. To insure this, the mixture is often adjusted to give a flue gas having not more than 1 to 2% carbon monoxide content, which is not dangerous because of adequate flue facilities provided.

The burners are made or moulded of alundum or fire clay material to form burner tunnels, which are inclined in such a way as to direct the flames in the most effective manner upon the highly refractory carborundum faced bed.

In the high pressure gas system small compressors are utilized to boost the city gas from line pressure to about 10 lbs. per square inch before it enters the patented mixing tubes. These venturi mixers maintain fixed air gas ratios over a wide range of consumptions, irrespective of the quantity of gas used.



Another type of patenting furnace.

Temperatures are controlled by the regulation of needle gas valves, which govern the gas flow. By raising or lowering the pressure indicated on small pressure gauges before each inspirator, the amount of gas supplied is increased or decreased, thereby raising or lowering the temperature. That is, the pressure is an indication of the quantity of gas being consumed. These gauges have a range of 0 to 15 lbs. per square inch.

In the low pressure air gas system the air instead of the gas is controlled by needle valves. In this system pressure or turbo blowers are utilized to supply air to the inspirators at pressures varying from 1 to 2 lbs. per square inch. A diaphragm gas pressure regulator reduces the gas pressure to atmospheric before it enters the inspirator where it is proportioned with air in the correct amount for complete combustion. Otherwise these two systems are identical as far as method of firing is concerned.

Import of Needles.

In 1925 United States imported 899,569 of hand sewing needles valued at $1,039,815. According to the Iron and Steel Division of the Department of Commerce, the hand sewing needles came mostly from the United Kingdom, valued at $778,036. Germany sent us 258,453 needles valued at $194,687. Germany sent the greatest number of other needles valued at $188,429. Czechoslovakia sent us $139,781 needles valued at $53,685.

The Profits of High Overhead

How a great wire company has secured and maintained a lead through intelligent use of high overhead expenses

*By L. S. Horner**
Vice President, The Acme Wire Company

AS we see it, and as we have seen it ever since we entered the business in 1904, a concern may intelligently choose to be a follower or a leader. It will make a satisfactory profit in either class if its management is really competent.

And this is true whether a concern be large or small. It is likely to be as true in a merchandising business as it is true in manufacturing.

Some stores, for instance, will give superlative service in directions which are not strictly necessary. Perhaps they spend an extra 1% to deliver the same day all goods purchased before 2 p. m.; it may be that they are a bit more liberal in adjusting complaints than they would have to be in absolute fairness. Or their window and store decorations are more elaborate—more expensive—than those of any other store in town. What of it? A certain section of the public will shun them to be sure. But the folks who are willing to pay more and get more will come to them as first choice.

The leaders are committed to a policy of generous overhead, expended wisely along lines that lead to recognized preeminence in their industry, and to profits.

The follower—and in any line of business or industry this type of concern is in the large majority—must depend mainly on price and selling energy to make his sales; so he must keep overhead down. The leader, on the other hand, must spend money with some freedom in order to maintain himself in the lead. He gains and holds his business principally among those customers who are willing to pay a little more at the one source in order to get the advantages in quality and general service which the leader offers.

When we entered the magnet-wire and coil business back in 1904, we made up our minds that we were going to be leaders. We did not splurge at the beginning, and we have not splurged since.

But we have steadily plowed into the business, in the form of "unnecessary" overhead, a considerable sum of money which could never be recovered in a lump. We have plowed it in so that we could be leaders. By being one of the leaders, and maintaining this position, we have been able to serve our customers better than we otherwise could have served them. We have bettered the whole electrical industry in many respects. And we have made good profits by our activities.

If we were to eliminate our research, our development work, and our extra inspection operations, we could reduce the price of our product at least 5%. But unless some one else in the industry carried on the particular work which we have been doing, customers would pay more for our type of product over the next few years. For we aim always to improve the product and to reduce the cost of materials.

The "unnecessary" overhead of laboratories and research engineering experiments must be spent by some one if the industry is to progress. Unless an industry progresses, it cannot serve its customers increasingly better.

Somewhere more than half of all new concerns start as offshoots of older established firms. In general, the men who organize these new companies have had a rather one-sided experience. When they start out they are usually either salesmen or factory men.

In either instance, they are most likely to lack an adequate comprehension of what their overhead must amount to if they are to progress. By figuring the bare costs of making and selling — and then, more often than not, failing to include some important costs which cannot be avoided—they arrive at a base cost to which a small profit is added. The result is their selling price for their particular product.

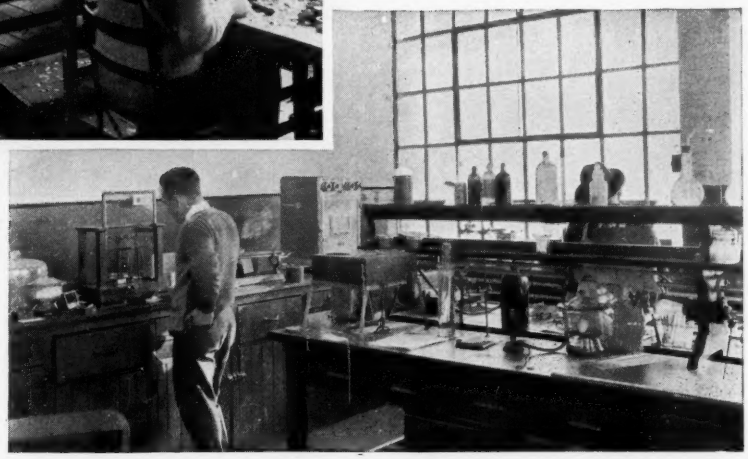
The next step is to book orders at this price, which does not provide a margin for the development work necessary in the business. For that matter, they are unusually lucky if their price brings even a slight margin of net profit.

There was one concern which, in its career, was typical of the history of many. It started up

*Reprinted by special permission from the April, 1926 issue of SYSTEM.

At left: Careful inspection is another costly essential of leadership. "If we were to eliminate our research, our development work, and our extra inspection operations all along the line, we could reduce the price of our product at least 5%."

Below: We have small experimental and control laboratories, each one of them well equipped and in charge of an able man.



with two men of good shop experience at its head. These men put in all their own money, which was not much, and induced several men of means to add to the firm's capital. They left their employer, fixed in their idea that machines plus a knowledge of the manufacturing end would suffice to make profits for them in a branch of our industry which has never allowed any very rich profits to any one.

As the first step after they had their plant about ready, they solicited known large customers of their former employer. They offered their goods at a very low price, and they got a good deal of business of course.

But they failed utterly to realize that they must invest more money in stocks of goods-in-process, accounts receivable, plus development work to improve their product beyond what they knew about it when they left their employer. They did not see that this side of the business would require money in excess of what they had to spend merely for machinery, building, and office help. They overlooked the effect on their overhead of the carrying charges for these additional large sums of money because they had lost sight of the need of these sums.

Of course, their prices were ruinously low! Of course, they lost money steadily. And, of course, after a few years, they failed because all their own cash was gone and their backers refused to put up more money.

Yet this sort of career for a new business is ordinarily unnecessary. Just because a business starts out in a small way, with a minimum of operating capital, it does not consign itself automatically to being a follower. More often than not, the competition at the bottom is so keen, with everybody crowding everybody else on a price basis, that nobody notices up among the leaders an opening all ready for some concern which will come into the industry as a specialist in highest quality service and product.

Long experience or years of careful research are, in a great many industries, including ours, the only road to travel. There are no short-cuts.

The concerns in any line which start from scratch, and with few advantages steadily develop into outstandingly prosperous businesses, are usually those in which the management has seen the opportunity to get right up among the leaders, themselves.

By adopting the other policy, by putting all the emphasis on underselling competition on products or service "just as good as" the leaders', and then by holding to this policy, the management consigns its concern to be a follower in the industry, rather than a leader. It has to wait until one of the leaders works out an improvement in process or product, and then as a matter of competition imitate this as closely as possible. But the follower contributes little or nothing to the gradually accumulating fund of technical knowledge and improved practice of the trade.

One can take no violent exception to this. If we bring out an improved product which is not patentable, it is open to any one who can make it. We increase our overhead to develop the new product; we must, of course, get that money back somehow or other.

As a general rule, we get back our higher overhead plus a profit. Otherwise we should have ceased, long ago, to perform the developmental and experiment-

(*Continued on page 139*)

My Thirty-five Years of Wire

Recollections of events of outstanding importance in the development of the wire industry

By George A. Paff

Superintendent, Rod and Wire Depts. Wheeling Steel Corp.

This is the concluding instalment of a series of articles by Mr. Paff in which he has given an account of important developments in the wire industry. These developments covering a period of thirty-five years were presented in a manner interesting both to the laymen and the technical men of the industry

In the present article Mr. Paff describes the sudden rise of the wire industry subsequent to large consolidations.

THE Manufacturers at Steelville had, in previous years, been successful. A few years operation of the Rod, Wire and Nail Mills, was followed by the building of a Bessemer Steel Plant. Then in comparatively quick succession a Tin Plate Plant—a Seamless Tube Mill —and finally a second and larger Tin Plate Mill.

Practically the same group of stockholders was represented in all, and the funds for each successive Plant seemed to grow from the earnings of it's predecessors. However in the year 1896 a real problem was being faced and divers methods were unsuccessfully tried to change red figures into black. Gentlemen's agreements—the pooling of orders— and numerous other schemes all had their innings and failed.

The Rise of the Industry

We will not burden this story with a detail of how each one of these Industries in their turn were lifted out of the "slough of despond." The experience of the Rod & Wire Company was tpyical of the others and will serve for all.

Out of the middle West there came a gentleman of portly physique, a heavy flowing mustache and a determination that was equalled by few other men of his time. For the purpose of this article, we will introduce this gentleman under the fictitious name of Mr. John W. Sellers. Mr. Sellers had at first tried out and controlled a smaller consolidation. His experience in that venture seemed to whet his appetite for more fields to conquer. He was satisfied with nothing less than a complete combination of all existing Rod & Wire Plants. Manufacturers who were willing to relinquish their holdings on a basis of two for one were "easy picking" for Mr. Sellers. A few were more obstinate and held out for a more prolific "shaking of the plum tree." Some demanded and obtained as high as three for one, and perhaps even more for their possessions.

It is not the purpose of this article to go into detail on figures of this nature for they would serve no special purpose at this time, even if we were in possession of all the facts.

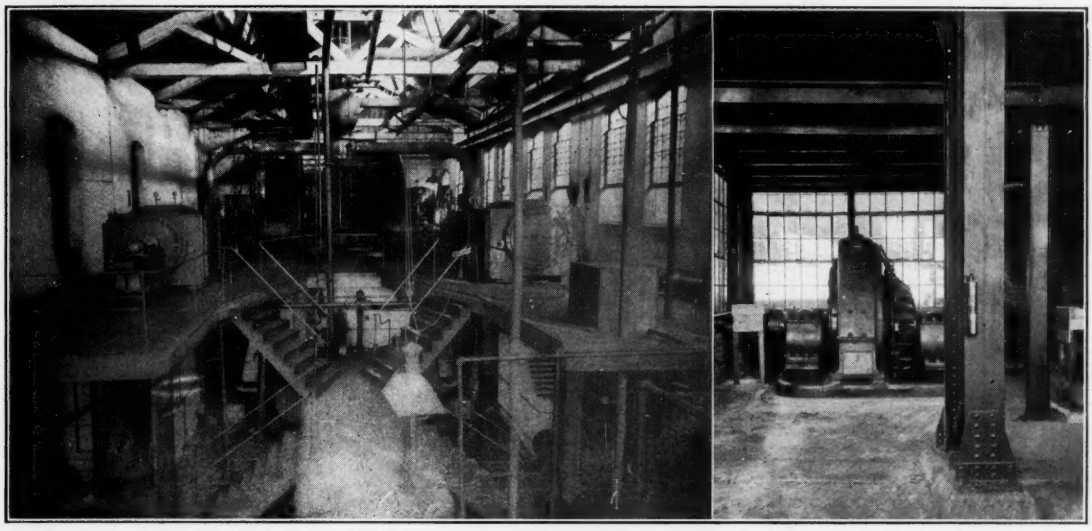
In rapid succession there came other men of the Sellers' type who were interested in other branches of the Steel industry. Things happened so thick and fast in those days at Steelville, that they are now but a hazy memory to the inhabitants and especially to the stockholders of those various plants. It was a common occurrence at the time for the Share Holders to glance at their morning paper and discover in glaring headlines their first information that every dollar they owned had been doubled and in some cases trebled over night. The Utopian dream had become a glowing reality. Aladdin's Lamp was indeed working over time.

The leading banker of Steelville who had always handled the financial part of the steel making problems would never permit the actual figures to appear in the local press.

In order to avoid the use of more voluminous figures, we will take the case of our $90.00 per month Superintendent referred to in part one of this story. We use his case for the reason that we know whereof we speak.

He was indeed an honest, dependable and aggressive official and had won his way into the good graces of the higherups who were in a position to assist him. His first investment was but two or three years before the time of which we now speak. He was permitted to take $3,000.00 worth of stock in the first Tin Plate Plant. For this he used some shares he had for a number of years been carrying in a Building & Loan Association. He was enabled to slightly augment his holdings as each successive Plant was built. When the magic smoke of consolidation cleared our Superintendent friend who but about four years before had included every dollar he owned in the first $3,000.00 investment, found himself to be worth in actual cash the tidy sum of $40,000.00, and this, as previously intimated, has since by wise investment been multiplied several times.

We have used this more modest illustration for the obvious purpose of avoiding citations of such estates as were advanced from six figures to the "Multi" class.



A striking illustration of the changes in the wire industry brought about by the introduction of new machinery. It was not so long ago that the engine drives shown at the left were employed for the work now performed by the comparatively small electric motor at the right.

Will this ever occur again? We do not believe it will ever again occur with the same degree of profit to the stockholders.

We will conclude "Reminiscences" by relating an outstanding incident in the life of this man Sellers who more than any other individual, was responsible for the consolidation of the Wire Plants. He had a remarkable capacity for detail and, as an Organizer, had but few equals in his time. Unfortunately, however, he had one very marked weakness. He was an inveterate gambler and by reason of his activities in that particular line earned a "nom de plume" by which he was known to his dying day. Inasmuch as the incident to which we refer was brought out by his private secretary in an article which not so long ago appeared in one of our leading publications, we do not believe that a breach of ethics is being committed by making further reference to it here.

The occurrence is still fresh in my memory although I did not at the time know what it was all about. In that eventful week, Mr. Sellers had sold heavily short the stock of the major corporation then under his control. Immediately after the close of the market on Saturday, practically every plant of his company received a dispatch to close down at the end of that day. Many thousands of workmen, which included myself, were, without warning, thrown out of employment and with no assurance of an early resumption. The press carried heavy headlines in announcing the sudden and wholesale suspension of operations of the dozen or more plants included in the Sellers group.

Could there have been a more perfect setting for a stock market "killing?" This act, perhaps more than any other, cost Mr. Sellers his standing with the financial interests and especially with the house of Morgans. He had made a "grand slam," but it was accomplished with a "cold deck under the table." Five aces in one hand was exactly one more ace than even Wall Street was willing to stand for.

In the September issue of

WIRE & WIRE PRODUCTS

an article will appear

on

"The New Ford Wire Mill"

It has always seemed a great pity that John W. Sellers was possessed of this insatiable desire to speculate, for the Steel business indeed lost a real captain of industry when he passed out of the picture. He had a most intimate knowledge of the operating and commercial details of the business and always showed marked ability in placing the right man in the right place.

It is worthy of note that the personnel of the organization he founded has—with the exception of such changes as are naturally wrought by the stealth of time —remained intact.

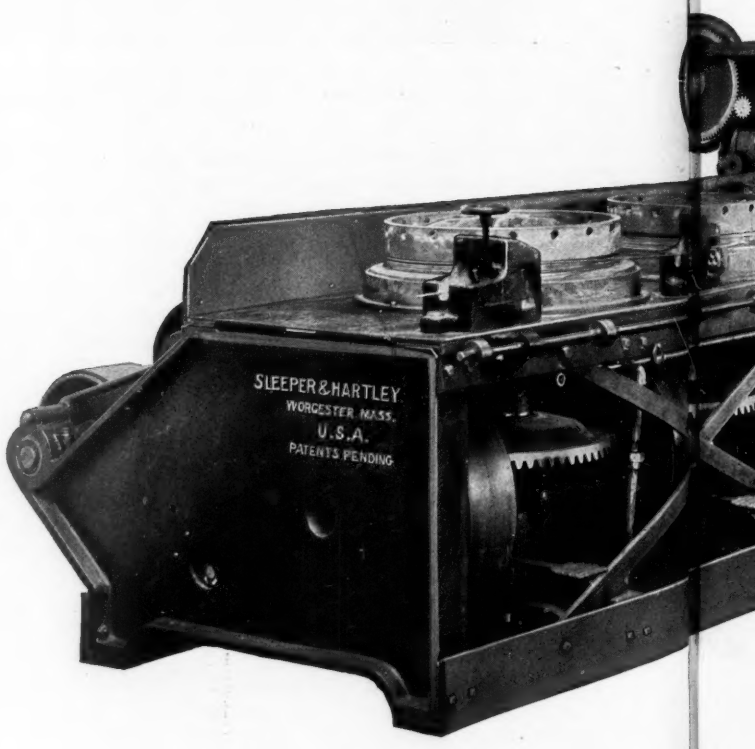
And now to a conclusion. Looking back over the experiences of more than a third of a century, we cannot but wonder just what the reminiscent writer of five and thirty years hence will have to say of the present time. Whatever it may be, here's hoping that "WIRE AND WIRE PRODUCTS" will be here to record it.

Oh a wonderful stream is the River of Time
As it runs through the realm of tears.
With a faultless rhythm and a musical rhyme
And a broader sweep and a surge sublime
As it blends in the Ocean of years.

CONTINUOUS WIRE DR

Sleeper & Hartley TRADE MARK

Patented in United States of America and the Principal Foreign Countries



CONTINUOUS ROD FRAM—N

Built with 3, 4 or hea

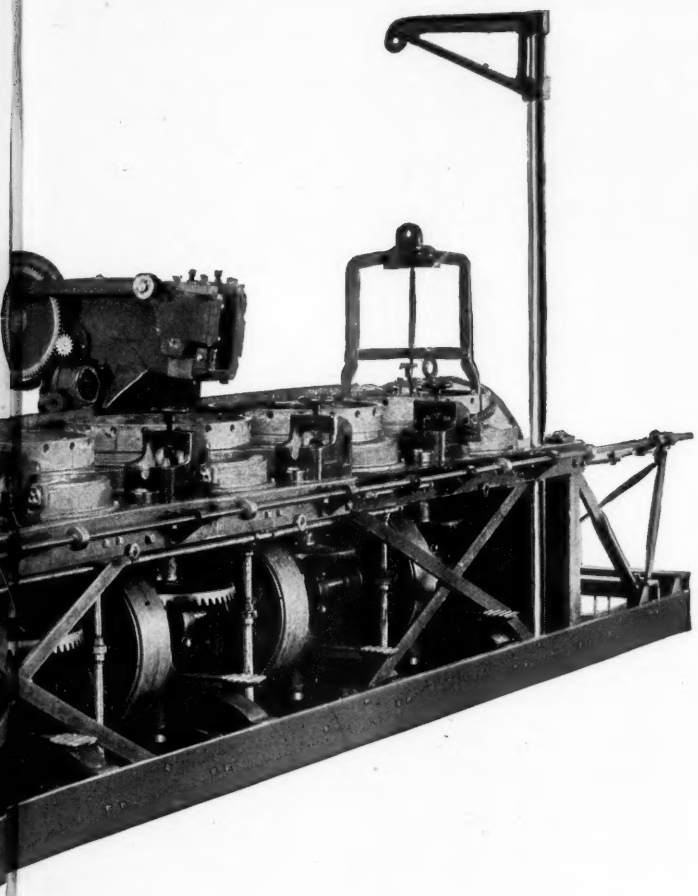
This machine is built without differential gearing of an kin of drawing heads. These machines are put into produtio

AGENTS: CHICAGO TERRITORY, Neff, Kohlbusch & Bissell, Inc.

WORCESTER SLEEPER & IA

FOREIGN AGENTS AND REPRESENTATIVES: UNITED KINGDOM—Mr. Fredk. A. Perry, 63 Queen Victoria St., London. E. C. 4. FRANCE—Mr. Edgar Bloxham, 12 Rue du Delta, Par is. BELGIUM—Isbecque, Todd & Cie., 25-27 Boul. Emile Bockstael, Brussels.

RAWING MACHINERY



Sleeper & Hartley TARRADEENARAK

An All-Ball-Bearing Machine

High Production

Low Maintenance Costs

Machine shown here is set up to draw No. 5 to 15

Runs off 4170 lbs. in 10 hours

—No. 5 to 14 or 15 WIRE
heads, as desired

kind. Automatic compensation for variations in speed
tion immediately after making the motor connections.

ARTLEY, Inc. MASS.

ITALY—Henry Coe & Clerici, Milan. AUSTRALIA AND NEW ZEALAND—Edwin Wood Pty., Ltd., Melbourne.
JAPAN—Andrews & George Co., Tokyo. SWEDEN AND FINLAND—Akt., Rylander & Asplunds, Stockholm.

EDITORIAL · IMPRESSIONS

Accident Prevention

THERE need be no other urge for the scrupulous care for the safety of the worker, than common humanity. However, not merely because it is humane, but also because it is good business policy, industrial practice should under no circumstances neglect the safety of labor.

Measures of safety offer a difficult problem to plant managers, and the problem will not be solved by the posting of warning signs. A wide experience and a keen insight into the psychology of the worker must unite to provide adequate safety without carrying this practice to the inordinate extent where instead of ensuring safety it merely instills fear into the worker's mind.

Such enlightened and effective safety measures cannot be based on tne limited experience of individual plants, but must rest on the accumulated data of industries at large.

We offer our support and encouragement to the Labor Department's efforts to initiate a movement for a unified standard system of reporting and distributing information about industrial accidents. At the recent conference on accident prevention, the Secretary of Labor, emphasized the imperative need of more comprehensive and standardized accident statistics.

Ultimately, the application of measures recommended by the conference, will rest with the individual manufacturer and it is to be hoped that the conference will nave their co-operation.

At present the organization of State and Federal statistics is still under way. It is suggested in the resolution adopted by the Washington conference that "the Secretary of Labor call an annual conference at Washington for the continuance of the constructive work in connection with industrial statistics and industrial accident prevention which was originated in this conference."

In an effort to further this movement, Wire and Wire Products in an early issue, will publish a symposium on the subject of safety measures in the wire industry.

Technology of Wire Drawing

EVEN a cursory survey of technical literature bearing on the wire industry, would reveal the utter poverty of recorded research. Since 1891 only two books dealing with wire drawing have been published, outside of such booklets of instruction as the larger plants distribute among their personnel.

Why is the wire industry inarticulate? Is it because the results of research are too precious to publish? Or is the scarcity of wire literature due to a general indolence on the part of the technical men of the industry?

Academic research on wire is even more infrequent. There is hardly an engineering school in the country that offers courses treating of wire drawing and allied problems, while the technical journals which carry articles on every phase of engineering, seldom touch the important and little known technology of wire drawing.

There is remarkably little research done on the basic problems of wire drawing. The question, for instance, of the internal structural transformation of metals undergoing cold working is of vital importance to a thorough understanding of drawing processes. And yet how little it has been studied!

This and other problems of pure, scientific—not merely industrial—research may have incalculable influences on the development of wire drawing technique.

WIRE
& WIRE PRODUCTS

Yes, such work involves large investments, high overhead expenses. But there is a profit in it, as the Vice President of the Acme Wire Company shows in an article on page 122 of this issue.

In the long run, it has proved profitable in other industries. Why not in the manufacture of wire and wire products?

Standardization

One feels that freedom of initiative and private judgment is the birth-right of man, and on this principle not a few industrial administrators still think that standardization reduces men to the level of machines, prescribing their every action.

But standardization on closer study will seem no more an infringement on personal freedom than such laws as the crystalized common sense of society has seen fit to enact. It is an application, with rigor and accuracy, of the principles derived from the broad experience of our industrial era.

When applied to labor it is a vehicle for industrial education, a sound and constant insurance against accident and it eliminates unnecessary fatigue.

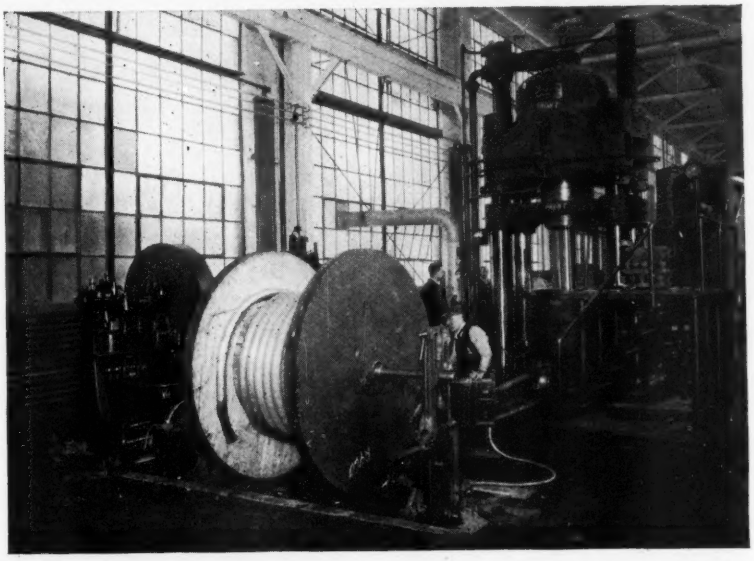
Standardization, when reasonably carried out embodies the best practice of an industry and stimulates further initiative and research. The large nation-wide engineering organizations offer ample evidence of this fact. Their committees on standardization have solved many vital industrial problems and were highly instrumental in eliminating those haphazard methods which have come down to us from earlier stages of industrial development.

Nor need standardization inculcate any particular industrial practice as immutable tradition. What has been standardized remains in force only until a better standard is found. In the meanwhile, its provision for regularization makes for order, cooperation and safety.

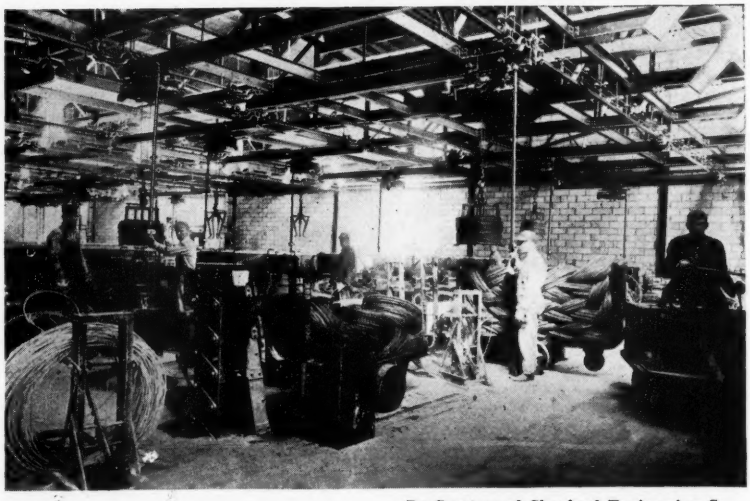
(*Continued on page 136*)

WIRE IN THE NEWS

Right: An interesting view of a 2600 ton hydraulic press used for sheathing electric cables with lead. The photograph was taken in the General Electric Company's plant.



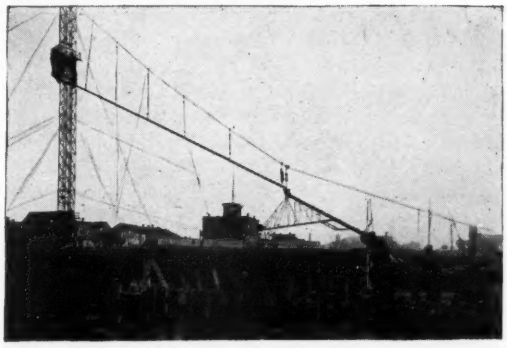
By Courtesy of General Electric Co.



Left: An unusual view of a wire drawing plant showing methods of conveying the coils. Note the intricate system of overhead cranes with block stripping attachments.

By Courtesy of Cleveland Engineering Co.

Right: Wire rope has found a new and extensive outlet since reenforced concrete came into prevalent use. Photo shows a concrete - distributing tower.



If you have photographs of interest to the Wire industry, send them to Wire & Wire Products.

Lubrication In Wet Wire Drawing

By C. P. Gulick
National Oil Products Co.

IT might be well in starting this article to differentiate between what is known as wet drawing and dry drawing. The terms "wet" and "dry" apply to the character of the lubricants used in the drawing operation. In "wet drawing" we usually mean that the lubricant is in emulsified state with water as the vehicle and this emulsion or emulsified oil or fat combination is the lubricant employed.

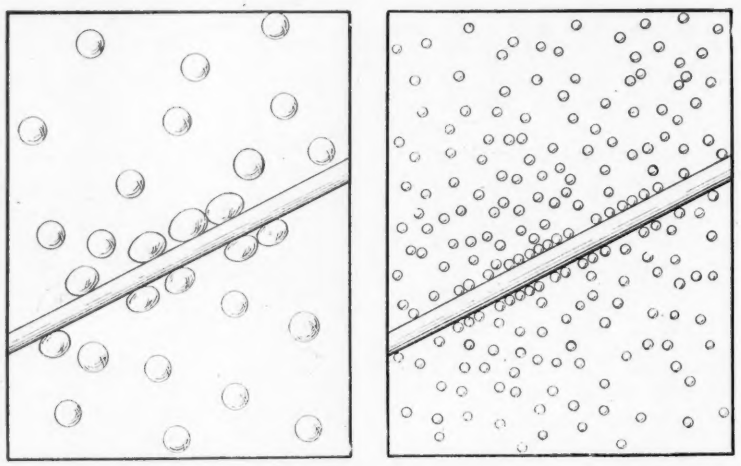
In "dry drawing" there is no water whatever used and for this class of work soap powders or similar dry substances where water is not present, are used as a direct lubricant in the block at the die.

It is the purpose of this article to discuss only wet drawing and in this connection we will confine ourselves entirely to the subject of drawing of heavy wire. Wet drawing is ordinarily applied to copper and brass wire, particularly the former or in other words, wire which is soft and malleable in composition.

Probably the most commonly used lubricant for this type of work is either some proprietary compound consisting principally of soap or saponified fats with free fats such as tallow, and in some cases petroleumm oils also enter into the combination.

Some mills make their own lubricants of this character by boiling up a mixture of soap such as Castile or even whale and fish oil soaps and to this soap liquor a given quantity of tallow or other grease is added and boiled until the whole substance takes on the character of an emulsion. This emulsion is then used in the drawing machine, the wire passing thru the emulsion and picking up a sufficient amount and carrying it to the die to act as lubricant in the drawing operation proper.

Anyone who has studied emulsions either chemically or physically in connection with lubrication, knows that the efficiency of any given emulsion depends not only upon the ingredients used, but the skill with which the emulsion is made. In addition to this, the actual construction of the emulsion is a matter of prime importance. An emulsion is essentially a milk-like substance in which fats of some character are broken up into minute globules and suspended in a watery vehicle by the means of some stabilizing compound such as soap or alkali. The quality and quantity of soap employed has a direct bearing upon the fineness of the individual globules of the suspended fat. The character of the suspended fat is also important. The quality of any given fat for purposes of emulsification is dependent in large measure upon the free fatty acid of the fat. In other words, you may have a perfectly fine grade of edible tallow which is very low in free fatty acid and yet is very poorly adapted for the making of emulsions due to the fact that the fatty acids play a very important part in the emulsification of the fat proper.



In a lubricant in which the dispersed fat is in large globules there is greater tendency for the wire to take the free fat out of the emulsion than where these globules are small.

All soaps upon being diluted in water go thru a process known as hydrolysis which means a splitting up of soap into its component parts of fat and free alkali. The free alkali thus liberated increases in proportion as the dilution of the soap progresses. This free alkali in turn acts upon the fatty acid of the grease or tallow and emulsifies them thus rendering the entire mass into a state of emulsion resembling milk, which is the ideal type of emulsion.

It may be readily seen from the foregoing that in order to produce emulsions in the mill of uniform quality and stability, it would at all times be necessary to employ a soap that would hydrolize to exactly the same degree, to have the same grade of tallow or fat with identically the same percentage of free fatty acid present. These conditions are practically impossible of accomplishment. Inedible tallow is a by-product and varies materially as to percentage of free fatty acids, depending upon the extent it has decomposed, during storage. All animal and vegetable fats are subject to decomposition and its consequent decomposed products of which fatty acid is one. The percent of free fatty acid present in tallow, would therefore depend upon such conditions as time of storage, tem-

perature, freedom from moisture and other conditions which tend to promote rapid decomposition.

From this, it can readily be seen that it is practically impossible for any mill to obtain a grade of tallow which is chemically uniform at all times. Because of this condition, the problem of manufacturing emulsions in the mill is a very difficult one and it is common practice for the operator who is responsible for making up the emulsion, to use his discretion as to whether he should add more tallow to the mix or more soap or a little alkali or what not. Naturally this rule of thumb procedure has a tendency of producing totally different chemical constructions in the emulsion itself and this naturally accounts for very irregular results at the drawing bench.

It will also be realized from the foregoing statements that this emulsion consists of quantities of free tallow or grease in an emulsified form, in which finely divided particles are floating thru a water vehicle. The wire has a greater affinity for these globules of fat than for the water when passing thru the bath, consequently these globules are picked up by the wire and carried to the die. This means that there is a constant exhaustion taking place in the emulsion of the fat or tallow which is one of the prime elements of lubrication. This process continues until the die begins to heat which means a rapid wearing of the die with consequent scratchy and irregular wire.

The ideal condition of the emulsion of course is one where proper balance between fat and water can at all times be maintained without exhausting the fat present in the bath. This is a condition however, which is practically impossible to obtain in any soap type emulsion.

One of the principal reasons for this is the fact that the soap type of emulsions cannot be made of sufficiently fine construction, that is, where the

(*Continued on page 133*)

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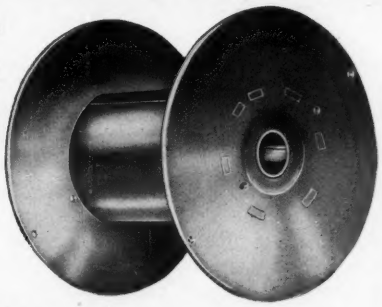
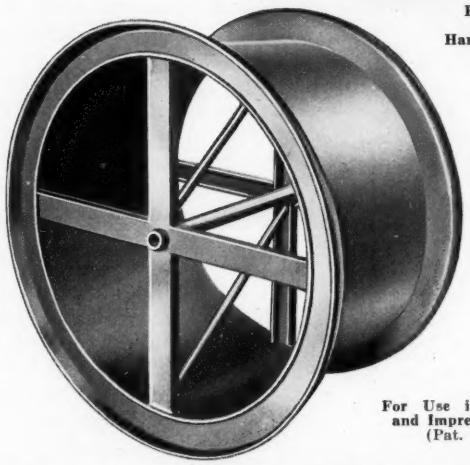


For Annealing and Handling Fine Wire



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A man now selling in the wire industry can make good money with this side-line proposition. No samples, easy to sell, and good commission. Write Box 101, WIRE & WIRE PRODUCTS, 461 Fourth Ave.

POSITIONS WANTED

Have had several years' experience and understand all production problems in the wire business. Have been foreman for many years. Desire better position. Write Box 102, care WIRE & WIRE PRODUCTS.

Eleven years assistant Chief Engineer in large wire mill. Desire position in drafting room or selling. Write Box 103, care WIRE & WIRE PRODUCTS.

FOR SALE

3 DOUBLE WIRE DRAWING MACHINES, 8" drums, 14 dies per side, individual clutches. Good condition.

4-12 Spindle Wire Spooling Machines in first-class condition.

500 Blank Mossberg Pressed Steel Spools; 4¾" flange diameter, 3⅛" traverse by 1¾" barrel; used very little.

SPRINGFIELD WIRE & TINSEL CO.,

67 Taylor S. Springfield, Mass.

NEWS OF THE INDUSTRY

JOHN C. SCHEELER has been elected president of the Buffalo Wire Works Co., Inc., Buffalo, to succeed his father, the late Martin Scheeler. Other officers of the company are F. M. Grimm, vice-president, and C. A. Scheeler, secretary and treasurer. The Buffalo Wire Works Co., Inc., is over half a century old and is a prominent manufacturer of wire products.

JOHN E. FREDERICK, president of the Kokomo Wire and Steel Co., Kokomo, Ind., has recently been re-elected president of the Indiana State Chamber of Commerce.

HAVING removed from a down town plant the firm of Louis Eshner and Son, now is located in larger quarters and more modern surroundings at 9 W. Rittenhouse St., in Germantown District, Phila. The firm manufactures and deals in general wire products. The old location was at 950 N. 8th Street. The members of the firm are Louis Eshner and his son, S. M. Eshner.

Colonel W. A. Roebling, eighty-nine, builder of the Brooklyn Bridge and President of John A. Roebling Sons, died on July 21 in his home. He was a graduate of Rensselaer Polytechnic Institute, a classical scholar and an excellent musician. He was widely known as a mineralogist.

Since the completion of the Brooklyn Bridge he had devoted his time to the direction of his wire manufacturing plant in Trenton.

WIRE screens and guards, ropes and other products for the building of the Pennsylvania Railroad Bridge over the Schuylkill River, now under way is being supplied and produced by the firm of Adams Crawford Company, 310 N. 4th Street, Philadelphia.

A LARGER home is to be acquired for the Kensington Pile Wire Works, 2642 North Mascher St., Philadelphia, manufacturers of wire for carpet weavers use and for the handles of storage batteries. The new location is in the mammoth factory structure at Second and Erie Streets where George Weinman head of the firm will expand the business. The removal of the equipment will be carried out throughout the summer months and installed, ready for occupancy by September. The firm also is engaged in the manufacture of machinery.

WITH a business history extending back to 1868 the Thomas Hamilton's Sons and Co., 1340-52 E. Berks St., Philadelphia, is about to pass into other hands. Having for more than fifty years been associated with the wire industry the present veteran head of the firm and son of the founder, Frank M. Hamilton, is about to retire from the industry.

AN unusually large contract for the supply of specially constructed heavy wire equipment for the partitioning of the galleys and other parts of the largest vessel to be devoted to passenger steamship service now in course of construction at Cramps Ship Yards has been

(*Continued on page 136*)

THE MASTER DIE

The STEEL DIE of UNIFORM SHAPE and SIZE

The Die of Positive Self Lubricating means

FOR FULL PARTICULARS WRITE TO

MASTER WIRE DIE CORPORATION

408 Concord Avenue New York, N. Y.

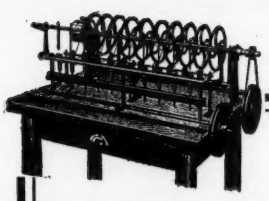
Lubrication in Wet Wire-Drawing

(*Continued from page 131*)

individual globules are microscopically small and that therefore there is a greater tendency for the wire to take the free fat out of the emulsion than would be the case if the globules were of such small size that they would not be picked up by the wire but would remain intimately mixed with the entire water vehicle.

Within the past couple of years a new principle in the manufacture of emulsions has been applied to the wet drawing of wire which overcomes these obstacles. In this principle, a sulphonated base is used as the emulsifying agent rather than soap. By a sulphonated base we mean a fat product such as tallow which has been put thru a special process whereby it has been rendered very highly soluble without the use of alkalis as in the soap making process. Because of the highly soluble state in which this sulphonated fat is rendered, it not only goes into very fine solution itself but has the additional property of mixing with and emulsifying other fats such as tallow in an extremely finely divided state. These sulphonated compounds do not rely upon the process of hydrolysis for their ability to emulsify but are inherently highly soluble and therefore do not have to rely upon the liberation of free alkali for their activity. The major difference between the construction of a soap emulsion and emulsion of sulphonated compounds is that the latter are not necessarily alkaline in reaction nor are they easily thrown out of solution. It is practically impossible for them to float-out free fat, grease or oil to the top of the bath.

They do not readily render up the free fats to be taken out of the drawing emulsion by the capillary attraction of the wire, but remain uniform and stable until the bath is practically exhausted. In addition, they are very much easier to handle than soap emulsions as the latter us-



"POHENKRA" WIRE DIE POLISHING MACHINE

Indispensable For All Kinds of Wire-drawing

U. S. Patents
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1039186—1912
England 16171
1910
France 420503
Germany 226062
Austria 46339

Gives an absolute guarantee of grinding the diamond holes perfectly round, a result hard to accomplish with all devices employed before.

Simultaneously grinds the entire wall of the draw stone, including the inlet and outlet.

Ten times more effective than previous devices; one workman unassisted can polish 30 diamonds simultanously.

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Continuous Wire Drawing Machine

A light, compact, and inexpensive machine of the ball bearing type, for rapid and economical production of fine wire.

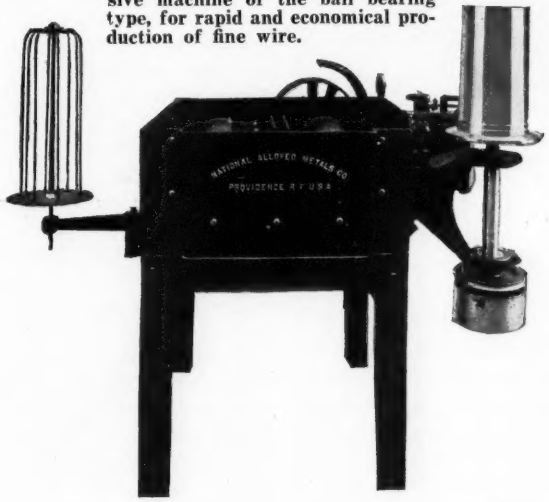

Illustration features No. 2 Machine. Capacity No. .20 B & S to .003.

We will furnish information on other sizes.

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Wire Drawing Soaps and Compounds

STEELSKIN BRAND

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For High or Low Carbon Wire

Working Samples sent on request.

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ually have to be boiled up which takes heat and steam and considerable handling, whereas sulphonated products are readily soluble in water and go into solution or emulsion upon slight warming and short agitation.

When this type of emulsion is used, the lubrication is so much more efficient and uniform that the dies wear materially longer before it is necessary to make a change. Because of this fact, the wire is brighter and smoother and freer from scratches and irregularities. Because of this lack of necessity of changing dies, not only is there a material saving in cost of dies but production is increased materially as it is unnecessary to shut down machines so frequently for changing dies. This condition is a direct result of the stability of this type of emulsion.

It is not uncommon, where soap emulsions are used, for the temperature of the lubricating bath to reach 175 to 180 degrees F. This is caused by the heat produced at the die. Then the wire dips again into the emulsion and the solution picks up the heat thus produced.

Where the sulphonated type of emulsion is used, the temperatures range from 135 to 140 degrees F. This is not only a proof of better lubrication but a proof of superior cooling ability which is very important when the character of the wire and the life of the die is taken into consideration. Another important point in favor of the sulphonated type of emulsion is that there is no floating grease and the machines are therefore very much cleaner in all respects. There is no clogging and grease sticking to the sides of the machine nor to the dies. This is a very important point not only with regard to the efficiency of the wire mill but to its sanitation.

Wire drawing is usually done on a piece work basis and any substance that enables the men to increase a days' production means dollars and cents in their pockets. At the same time it means lower costs for the mill.

Digest of Literature

CORROSION, CAUSES AND PREVENTION by Frank N. Speller, 621 p. The McGraw Hill Book Company, New York, 1926.

Reviewed by Eugene Grunstein

One realizes the importance of a comprehensive treatise on the prevention of corrosion when confronted with the fact that the annual replacement of metals lost through corrosion reaches almost two percent of the metal tonnage in use. This wastage of metals seems especially grave in view of our author's statement that "recent estimates indicate that the high-grade ores of the United States (if used in the present proportion) will last only about fifty years, and that the whole potential ore supply will be exhausted in 250 years."

In this timely volume Mr. Speller has undertaken the task of placing before us the result of recent scientific investigation relative to corrosion of metals, especially the ferrous metals. Not the least important part of the book is one treating of the theory of corrosion. The various types of chemical action involved in corrosion as determined by various investigators in this field are presented in this section. The frequent reference the author makes to his sources of information make the book a valuable reference work. The author addresses himself to engineers and the larger part of the book deals with the practical problems of preventive measures. A large chapter discusses the principles and methods of corrosion testing.

Of special interest to engineers engaged in the wire industry is the section dealing with the galvanization of wire. This thorough treatment compiles the most recent investigations published in French, and American technical journals.

An elaborate and invaluable bibliography is appended.

Annealing Wire in Salt Bath; Iron Age Vol. 117, page 928, April 1, 1926.

Article describes use of liquid salt bath instead of a fuel-fired furnace for annealing of wire. The Atlantic Wire Co., Branford, Conn., has successfully applied this Lavite annealing process. The salt to which is attached the name Lavite, is a special preparation developed and used by the Bellis Heat Treating Co.

Electric Winding gear at Manceau Fontaine Colliery; Engineer vol. 141, page 210, Feb. 19, 1926.

Description of installation of hoists for deep mines using flat rope wound upon itself like tape on a bobbin. The cable is 4,265 feet long and 200x25 mm (7.9x-0.985 in) in cross-section. It is composed of ten hawsers, each consisting of four strands of eleven wires each. Its weight is 11.9 kg. per meter of length (8 lbs. per foot) and its breaking strength is 212,000 kg. (468,000 lbs.)

Cables Metalliques Antigiratoires; Le Genie Civil, vol. 88, page 323, April 3, 1926.

A brief discussion of wire ropes designed to resist severe shock and torsional stresses, manufactured at the Wire Mills of Havre.

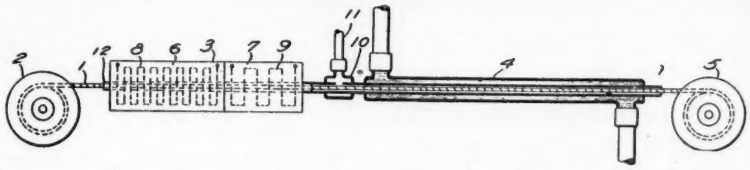
Profits in the Copper Wire and Brass Industry. A Notman, Mining and Metallurgy vol. 7, page 21, March 1926.

The author finds after elaborate inquiries that "the investment per pound of annual output in the manufacturing division is less than one-fifth of that in the raw material division (of the industry) and if we accept market values as indicative of income values, the manufacturing profits would appear to be fully double those of the raw material division per unit of investment."

Review of Patents

Conducted by
EUGENE GRUNSTEIN

Continuous Annealing Furnace



This invention relates to heat treatment of metals and more particularly to the heat treatment of material containing two or more metals, one of which would be harmed by an active oxidizing atmosphere and another of which would be injured by an active reducing atmosphere.

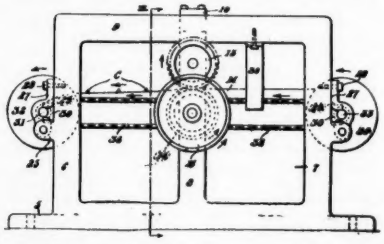
In the illustration 6 and 7 are two heating elements of different capacities and 4 is a cooling chamber, water-jacketed.

This invention was developed in connection with the heat treatment for electrical conductors loaded with magnetic alloy.

U. S. Patent 1,586,897 issued to J. W. Harris, East Orange, New Jersey, assignor to Western Electric Company, New York, June 1, 1926.

Wire Mesh Crimper

The primary object of the invention is to provide a machine adapted for crimping wire mesh, or the like which is fed through the machine in web form. The machine is adapted for forming different sized and shaped crimps and for arranging the

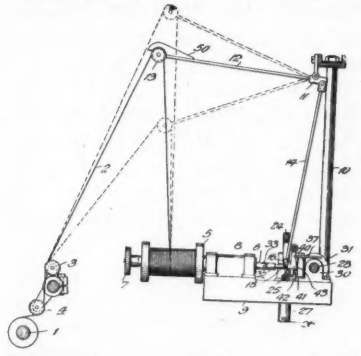


various crimps in longitudinal alinement or in staggered or overlapping relation in respect to the length of the web of material being handled. In the illustration the material M is shown passing through the crimping machine. The crimps formed are shown at C.

U. S. Patent 1,589,798 issued to F. J. Ewers, Sacramento, Cal., June 22, 1926.

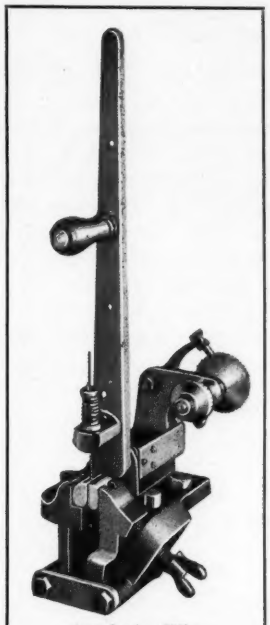
Control for Unwinding Wire Spools

This mechanism for spooling machines controls the speed at which the wire is paid out by the supply spool. If the winding



spindle is using the unwound portion of the wire more rapidly than the wire is being paid out by the supply spool the shortening of the portion between the spool and guides 3 and 4 will cause the supply spool by means of the mechanism to unwind the wire at a rate determined to be in excess of any expected rate. The resulting increase in the length of the paid out portion of wire will restore the speed to normal. A similar action occurs when the wire is paid out too rapidly.

U. S. Patent 1,589,435 issued to A. E. Scott, assignor to Varley Duplex Magnet Company, New Jersey, June 2, 1926.



Amsler's Wire Ductility Tester

The "Usefulness" of Wire in the Manufacture of Wire Products depends in Most Cases upon its "Ductility"

The best apparatus for investigating the ductility of round and flat wire, ferrous and non-ferrous, is the "Amsler Reversed Bending Tester" illustrated above.

This apparatus gives very valuable information. It can be operated by any intelligent man in the shop and it is inexpensive.

Every wire forming shop should be equipped with this handy, practical wire tester. Some plants are using a number of them in different departments.

Write for Full Description

HERMAN A. HOLZ

Testing Engineer
17-B Madison Ave. New York
Complete Line of High Quality Metal Testing Machines.

News of the Industry

(*Continued from page 132*)

awarded to the Kesting, Kopp Keyser Company, Inc., 444 Fairmount Ave., Philadelphia. The firm is to supply the entire wire partitions for the ship Malolo which is to be launched this month as one of the most modern of steamships afloat and the largest ever to have been constructed for passenger service outclassing the Leviathan in size. It will be ready for service with the new year.

HAVING made a tour of the Eastern States in interest of the line of wire ropes and steel cables manufactured by the Williamsport Wire Rope Company, Philadelphia Manager J. C. Crowell, has been informing the trade of the general good times prevailing in the industry in the various sections visited and particularly for the wire products consumed in the construction of large structures such as bridge and buildings and other corporate projects. The business of the Williamsport Company is reported to be a quarter million dollars over the same period of 1925.

JUST returned from a trip to Buffalo, N. Y., to the headqarters of the Buffalo Wire Works, Inc., where he joined in the sales and business conference of representatives from many States, General Manager George Hocking, of the Philadelphia Branch of the corporation is greatly enthused over the bright reports which were made by the various representatives.

LARGER Philadelphia headquarters are planned for the Star Serv Hanger Co., a branch industry of the L. A. Young Industries, manufacturers of wire springs reputed to be the largest producers of these products in the world, and operating seven plants in as many cities. The factory in the Quaker City located at Delaware avenue and Tasker street, is to be provided with additional floor space to manufacture its line of garment hangers.

The local manager is J. D. Rice and it is hoped that under his direction the installation will be completed by September and ready for operation.

Editorial Impressions

(*Continued from page 128*)

Several movements are now afoot in the wire industry for the standardization of materials and accessories. Such standardization should not merely improve processes of manufacture and the product, but lead to more exact specifications and therefore to closer agreement between consumer and producer.

Belgian Wire Plants Agree To Fix Prices

An agreement has been made between the different Belgian nail-making and wire-drawing plants for the construction of a bureau of machine wire by-products which will control the production and fix prices, according to advices to the Department of Commerce from the office of the commercial attache at Paris.

Actually, only those plants which are supplied with raw materials from Ougree-Marihaye will be under the supervision of the comptoir, which will have its headquarters at Charleroi. But the group of Clouteries des Flandres and Clouteries Otlet and that of Clouteries de la Paix, although continuing to sell direct, are said to have entered the agreement, and orders received by them in surplus of the tonnage which have been granted to them, will be shared by the comptoir.

The agreement went in force dating from July 1. It is reported in France that negotiations may be entered into with German nail-making and wire-drawing groups in view of an export agreement between Belgium and Germany.

The Manufacture of Wire In Germany

(*Continued from page 119*)

point, as the subject has been amply covered in the pertinent literature[1].

Commercial requirements have caused the adoption of a number of specifications for wire for diverse purposes. These usually cover certain fixed values for tensile strength, resistance to bending and torsional strains, and the like.

Regarding the requirements for zinc-coated and galvanized wire, the author has published several articles. The specifications for steel wire are usually much more stringent, and all manufacturers of this product have to subject their output to extensive tests to assure themselves that they are living up to requirements.

In forming any reliable judgement as to defects in material which result from improper treatment, a good knowledge of the effect of the mechanical working upon the wire is essential. Wire which has "overdrawn" usually exhibits distinct weakness, a diminuition in elongation, and, on microscopical examination, quite evident signs of destruction of the structure of the material, and plainly shows the direction of the pull to which the wire has been subjected.

In well regulated wire works, such conditions will rarely occur, so that wire of this nature is a comparative rarity. Much more common defects in wire are incipient breaks, which usually are due to spots where the wire is doubled, due to the rolling of seams in the wire-rods at the rod-mill. Then again there are "pipes", which were originally bubbles of gas or air in the ingots from which the rods were rolled. Another

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1. See E. Heyn: Die Umwandlung des Kleingefüges bei Eisen und Kupfer durch Formänderungen in kaltem Zustande und darauffolgendes Ausglühen. Z. V. d. I. 44 (1900), S. 433/41.

P. Goerens: Ueber den Einfluss der Kaltbearbeitung und des Ausglühens auf die Eigenschaften von Eisen und Stahl. Carnegie Scholarship Memoirs, London 1911 (siehe St. u. E. (1913), S. 438).

H. Altpeter: Beiträge zur Kenntnis des Einflusses des Drahtziehens auf die Eigenschaften der Flusseisendrähte, speziell auf deren Festigkeit und Biegbarkeit. Dissertation, Breslau 1914. Vgl. St. u. E. 35 (1915), S. 362/73.

common defect is segregation, caused by accumulation, in one spot, of impurities, such as phosphorus, sulfur and carbon. This occurs in all ingot-iron and is caused by segregation of the iron poured into the furnace at the steel-plant. If these segregations are not very severe, no great harm will result, but if unusually large, they will make the wire weak and subject to breakage during drawing.

Methods for the detection of this type of defect, according to Heyn, consist in etching the polished cross-section with copper-ammonium chloride to bring out the details. Seams and pipes can readily be detected to subjecting the wire to torsional stresses, in a specially construction testing-machine, which alternately twists the wire two ways. If the wire is doubled, or has pipes in it, it will split open as the result of this test. Occlusions of slag are also detected by this means, as they will cause the wire to fray at the defective spots.

Another common difficulty is brittleness due to pickling. This becomes evident when the wire is tested for pliability and for tensile strength. In such cases the wire soon breaks. Overdrawing, and the effect of improperly shaped dies, also adversely affect wire, the results having already been discussed above[2].

The annealing is, in all probability, the cause of most of the difficulties met with in the production of iron and steel wire. Uneven heating when annealing in pots, or changes in the speed of pulling wire through the annealing furnaces, will give rise to differences in the properties of various sections of the same coil of wire. Such unevenly annealed wire will cause further difficulty, in that it will have a variable resistance to the dies in drawing and will therefore draw jerkily. This not only puts a great strain upon the dies, but very often leads to breaking of the wire.

2. See also Birger Rydberg: Ueber die Entstehung sog. Grübchen und Kegel („cup and cone") beim Drahtziehen. Jernk. Ann., Jg. 15, Nr. 1.

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Dies for High Speed Wire Drawing Machines guaranteed.
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For drawing all kinds of wire

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Standard Electric
Wire Pointer

Made in two sizes:
No. 1 takes from No. 5 to No. 13 wire
No. 2 takes from No. 13 to No. 21 wire
Operates on either 110 or 220 volts Alternating Current.
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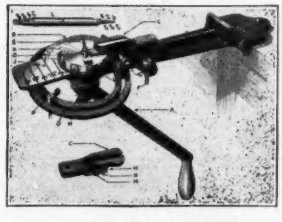
Adjustable for No. 3 to No. 24 Gage Wire.
The cut on the left shows a few of the thousands of the forms made on this FORMER
Price $35.00



Patented April 2, 1918
M. D. Kilmer & Co. Cleveland, Ohio, U. S. A.
Box 237, Station B.

under-annealed, the wire usually can not be drawn down successfully.

A further, and sometimes very serious, difficulty is that caused by too long or too hot annealing. When this occurs, it is possible to correct the difficulty by annealing for a short time at the proper temperature of 900°C. Annealed wire, which for some reason has been drawn down only about 8 to 16% of its cross-section, and then exposed to a temperature of from 650 to 850°C will exhibit a very coarse grained structure, with all its resultant defects, especially lack of toughness. (See P. Goerens, On the Influence of Cold-Working, etc. P. 385).

Metallographic examination is the best way of controlling the manufacture of wire, and will pay for itself in the form of a saving in otherwise wasted or scrap material. The best method of determining the presence of overheated or too long annealed material is a method given by Heyn called the "Kerbschlagprobe." The same method is also suitable for testing wire that has only been heated to a blueing heat, which is around 300 to 400°C. In this connection it is interesting to point out that, according to some experimments made by Lautz, that at 300°C, the point where incipient blueing of steel begins, the amount of bending that a wire will stand is only from ½ to ⅓ that which it will stand at room temperature. This is measured as the number of times the wire will stand bending before breaking[4].

The details of the manufacture of Steel Wire will be taken up in a future article by the same author, to appear in an early issue of this journal.

3. E. Heyn: Krankheitserscheinungen bei Eisen und Kupfer. Z. V. d. I. 46 (1902), S. 1115/23.

A. Pomp: Kritische Wärmebehandlung nach kritischer Formgebung von kohlenstoffarmen Flusseisen. St. u. E. 40 (1920), S. 1261 ff.

4. A. Lautz: Einwirkung der Temperatur auf die Biegefähigkeit von Flusseisen- und Kupferdrähten. Dissertation Berlin 1914, S. 28ff.

A QUESTION & ANSWER DEPT.
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The Future of the Wire Industry

(*Continued from page 115*)

It is true that the details of the day of Theophilus were refined, hot mills were built which rolled longer rods. Frames were built with heavier and better gears and productions were increased, but the old single shaft methods prevailed, and the laborious, crude methods of handling still persisted. Present day wire drawing, then, is a curious mixture of mediaeval mechanics and modern requirements. Wire mills are constantly demanding longer rods and providing means for handling the wire produced.

Of the real incentive for the manufacture of wire in America, the hoop skirt, we will say nothing, except that, fantastic as it was as a fashion, it had its very important role in furnishing the impetus for our great modern industry.

Industrial development opened new fields and made diversification and progress necessary. Civilization, wending westward, called for the enclosing of the vast prairies and the first great "tonnage" business—wire fence—came into existence. Bale ties for holding compressed inflammable bales of cotton in shape; rope, necessitated by ever-deepening mines and the development of cable railways; nails to supplant wooden pins and laboriously hammered spikes—all played a part in creating a demand for wire—and where there is a demand, there always is a means provided for its supply.

The future of wire drawing as an art seems now to be dependent upon several factors, resulting from economic conditions of the day. Wire drawing frames, in general, pattern very closely upon the designs of 1800. Man has evolved from the labor-loving, pains-taking artisan to the pleasure-seeking semi-skilled automotive engineer who regards work merely as a means to an end.

It is becoming increasingly more difficult to find men for the heavy labor necessary for the old-time single draft work: present keen competitive conditions, coupled with correspondingly low selling prices and high labor costs, make labor saving devices a matter of self-preservation for the wire manufacturers. Future development in the wire industry, then, is in the minimizing of labor and the increasing of production per dollar of labor.

These two conditions seem at present to be best met by the increasing use of continuous wire drawing machinery. Four, five, or up to ten drafts may be drawn with no intermediate handling of the wire—mechanical devices lift the rods on the reels, and "stripping blocks" allow it to be taken off with a minimum of strength. Speeds may be increased on finishing blocks to a point undreamed of a few years ago, and an operator may produce double the tonnage daily with a mere fraction of the effort previously required.

Whether this is sound economics or not—whether we are assisting in the development of a race of weaklings is not one for the wire manufacturers to argue—his concern is to produce wire—as much as is needed, and at a cost which will enable him to keep on producing it.

Competition is a hard master and self-preservation a strong incentive to progress. Without them we might now have myriads of swinging wire-drawers. With them we are slowly evolving machines and machine tenders. The pendulum is swinging back, the "mysteries" of the nineteenth century wire drawer are giving way to scientific principles worked out on the drafting board and in the laboratory. The atom is in the discard and the secrets of the electron are being laid bare in the most shameless way: rule of thumb methods are being supplanted by chemical formulae, all in an endeavor to reduce wire drawing to an automatic process, requiring less and less skill of the workman, for the noble and glorious end of reducing costs and enabling large and small manufacturers to exist.

What of the more distant future? Nothing is impossible; revolutionary ideas are the result of revolutionary conditions. The world has gone through many of these recently, and it is possible that the future will hold in its hand the scrapping of all our present machinery and the production of wire direct from raw materials as fully finished and perfect as was Minerva when she sprung from her father's brow.

We wonder.

The Profit of High Overhead

(*Continued from page 123*)

al work which go to make up our higher overhead.

Here, for example, is how it works out; the example is from years back, and is concerned with an improvement of more-than-ordinary significance in our business.

Back until 1907, automobile ignition coils were wound of silk-covered Number 36 wire—that is, a copper strand .005 inches in diameter. This silk-covered wire cost at that time about $3 a pound.

Our engineers, however, developed a method by which enameled wire the same size could be used just as well as silk-covered. In all respects as good, in some respects the enameled was better than the silk. And enameled wire suitable to the job cost about $1 a pound. Since there is approximately a half-pound of wire in a coil, the saving was considerable—something over $1 a coil. The automobile industry has benefited enormously from this development.

We began making coils of enameled wire and selling them like hot cakes. And we had the business to ourselves for a year and a half, or two years.

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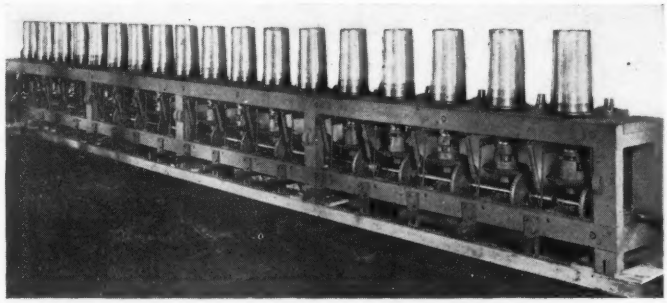

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Here comes in another phase of high overhead: adequate cost accounting. Cost accounting is expense, sheer expense; it costs money. But we maintain a most complete and competent cost department, because to do otherwise would endanger our purpose. We might begin losing money without knowing it, which is among the sure ways to reach the bottom of the list.

Some manufacturers who know their costs nevertheless elect to sell below cost to save the greater loss of a shutdown. This may under some circumstances be good business. But too many manufacturers sell at a loss because they do not know their costs, which means that eventually their losses drive them out of business.

(*To be concluded in next issue*)

Free Importation of Metals In Italy

By the terms of the royal decree-law No. 957 of July 5, a variety of metallic items were granted free importation into Italy. One article listed was steel springs for use in the manufacture of rifles. These are restricted to cylindrical springs of steel, weighing not more than 500 grams each, for the manufacture of rifles, (temporary concession, valid for three years).

Duty-free importation is granted also for aluminum in ingots, for the manufacture of wire, tubes, and sheets of aluminum, and for lead in pigs, for the manufacture of bird shot, wire, tubes and sheets.

Continuous Wire Drawing

(*Continued from page 117*)

geared for a heavy overfeed, traction is maintained in full, and the loop, entirely without attention from the operator, goes into live storage in such a way as to occupy no otherwise useful space. This is the Morgan-Connor machine, invented by R. Duncan Connor, sponsored in America by Morgan of Worcester, and already in the enjoyment of a degree of success both technically and commercially which puts it in a class by itself. Some 300 blocks are in operation on 3-4 and 5 draft work from No. 5 rod alone, a field which has never been successfully invaded by any other machine.

The present writer is responsible for the American debut of the Morgan-Connor machine and is directly interested in its success, and the reader is hereby warned that in the following account modesty shall not thwart the claims of justice.

In the Morgan-Connor machine the loop, which grows quite rapidly, lies on the block and its extension pins as though it were the accumulation of drawn wire on a regular single-hole block, which in effect it is. At the same time the wire is slowly paying off the block, through an axial opening, at the rate of demand of the next block. It is the axial delivery which permits this paying-off process to go on at a rate independent of the rate of accretion. The accumulated wire on each block is a reservoir to which wire is added at a rate corresponding to the speed of that block, and from which wire is automatically delivered at a rate corresponding to the speed of the next block. Each block is at once a drawing block and a free reel.

A little consideration shows the justice of the contention that the Connor process is best described as "single-holing continuously" and that the process combines all the advantages of continuous drawing with those of single holing, while escaping the weaknesses of both. Since the wire going to each die is perfectly slack, drafting may be as heavy as in single hole practice. Light drafting, such as may be prescribed for high carbon wires, is done on the same machine as heavy drafting, the only difference being the rate of growth of the loops, or rather, the accumulations on the pins of the intermediate blocks. Experience seems to point to a higher possible drawing speed than in single-drafting practice, though there is no logical reason for this unless it be the slight twist by the wire by virtue of its combination of overfeed and axial take-off. In any event speed is of minor importance in wire drawing.

Summary

This will be part summary and part prophecy, and the reader will have to make his own separation.

Continuous wire drawing is displacing the single-hole process and will drive it nearly to extinction. Its advantages are fundamental while its weaknesses are chiefly those of its raw material, and are steadily on the mend. Everything that strengthens single-holing practice will strength continuous practice in the same degree, but the reverse is not true. The logical field for the continuous machine (including the double-deck block) comprises probably over 85% of multi-draft work in terms of tonnage, and vastly more in terms of footage.

The field is divided into (1) wet drawing and (2) dry drawing, and dry drawing is further divisible into rod work and intermediate work. In wet drawing the fight is over: single-holing is not merely on the defensive—it is on the run, and will soon survive only in small jobbing and re-drawing units. In this part of the field the slip machine is cheap and fairly satisfactory and probably will hold its place. There is in this country no tendency to extend wet

drawing into larger sizes. In fact the opposite is true and not only mattress wire sizes but even some weaving wire is being drawn, as well as high carbon wire in corresponding sizes.

In dry drawing the position is more difficult and complex. As between rod and intermediate work, and speaking in terms of the slip or to the controlled loop machine, the intermediate field is much the easier to invade, and this for two reasons. First, poor stock has already dropped out in the early drafts, and such material as survives is practically hand picked for quality. Second, intermediate sizes come to the machine as round, well sized wire, generally normalized by annealing, and in the best condition to maintain that accuracy of size in process drafts which slip and controlled-loop machines required.

The intermediate field has already been invaded in considerable force by home-made machines, designed by the foreman and built by the master mechanic are bound to go, and where they are inadequate the small Morgan-Connor machines will take up the load.

In the field of rod-drawing the Morgan-Connor machine stands practically alone and it seems probable that, for some time to come, further advances in the art will be in the direction of improving the raw material and its preparation, and the dies, the objective being possibly higher speed, but certainly longer bundles. Clean steel and clean rods are within everyone's reach and are beginning to be appreciated. Electric butt welding of rods is a very easy trick to master. Improvement in dies has apparently awaited only a combination of circumstances that would give it full effect. The writer expects within a year to see more than one plant standardize on a rod bundle of 1000 to 2000 pounds, with a net increase in output per man reportable in hundreds of per cent.

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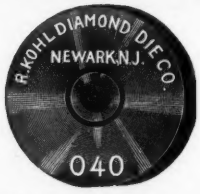

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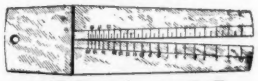

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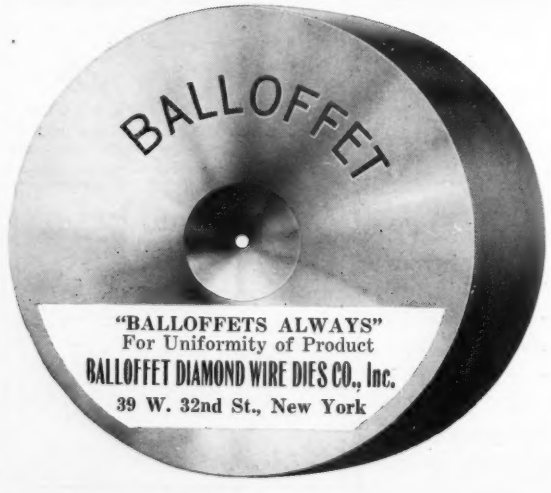

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"Instead of leading all other countries in the advancement of fundamental scientific knowledge," he declared, "the United States occupies a position far in the rear of the majority of European nations. A list of the awards of the Nobel prizes to men of various nationalities reveals the small proportion of first minds that we support."

—New York World Dec. 2, 1925

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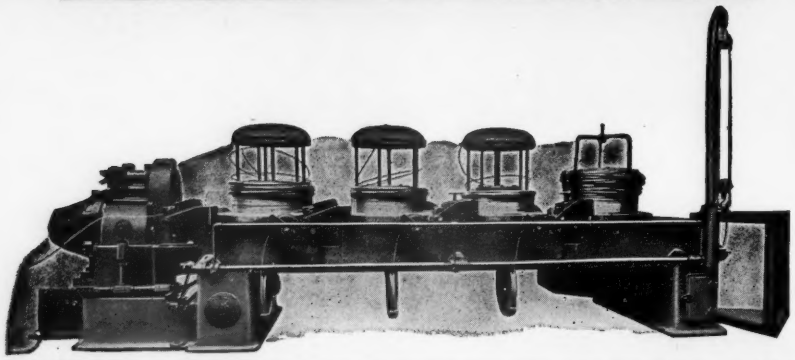

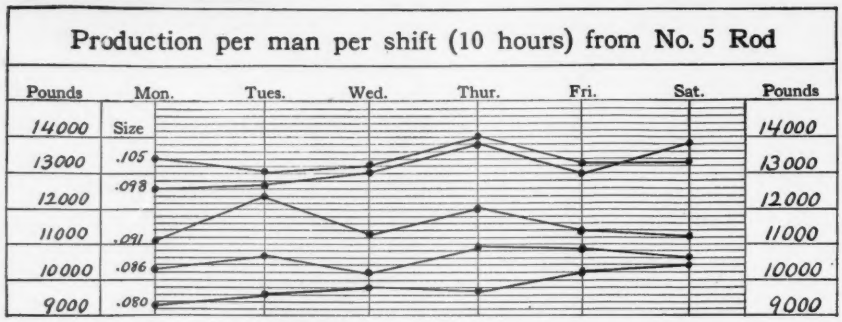

High Output per Man
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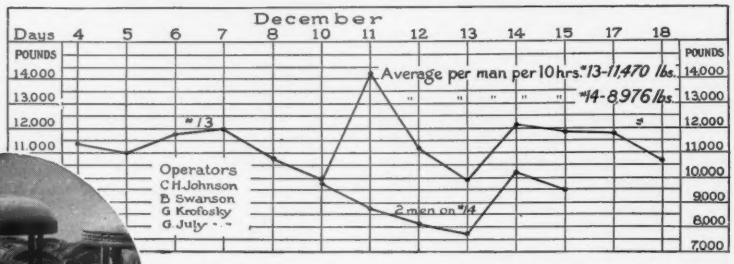

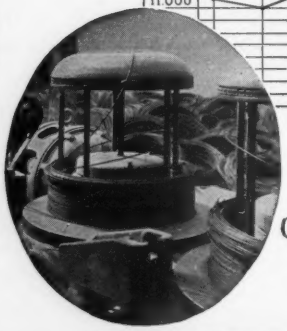

The chart above gives in the form of a composite curve the average output per man per day of four operators running eight machines at the Portsmouth Ohio Plant of the Wheeling Steel Corporation.

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